

## Appropriate Technology

## The Use of Algae as Potential Feed Supplement for Cattle

by Momena Khatun

Modern intensive farming practices have resulted in soils with deficiencies that are reflected in low-nutritional content of grasses and grains grown on these soils of Bangladesh and in the health of animals raised and maintained on these crops. Lush and otherwise nutritious grasses may fail to supply the needs of animals because certain trace elements in a naturally balanced form.

According to a Daily Star report earlier this year, 180 dairy farms in greater Jessore faced closure following an acute scarcity of fodder. There appears to be an ever widening gap between demand and supply of fodder.

However, a recent research project, jointly undertaken by BCSIR and BLRI, on the use of certain algae (Chlorella/Scenedesmus and Pediastrum) as potential feed supplement for cattle is the first of its kind to tackle this problem at the rural level in Bangladesh.

The regular supply of these algal feed supplement helps increase the utilization of all the ingredients in the complete feed-ration, improving the overall health and performance of animals, which cost only Tk 0.50 per litre of suspension i.e. the algal culture in edible medium.

Algae are being cultured in

various parts of the world to be used as human health food or animal feed and bio-fertilizer or bio-gas. Bangladesh is blessed with a large varieties of algae species. Different types of algae are available in low lands or water lodged areas in mixed forms. In 1964, the applied Botany Section of Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhaka, collected Chlorella/Scenedesmus, cells from nature in a highly impure state to obtain a pure culture in suitable media.

Chlorella is spherical in shape and about 2-8 microns in diameter. Its mode of propagation is a very simple method of cell division. It can grow in a wide range of temperature from 5°C to 42°C with the optimum at around 20°C to 30°C. It is also very hardy against attack by other organisms. The salient feature of Chlorella/Scenedesmus cells is their richness in content of protein, carotene and other vitamins, minerals and extracellular products. The protein of Chlorella/Scenedesmus contains all the essential amino-acids which are known to be essential for humans and animals.

Chlorella protein is 36 times higher than the protein yield of grasses. Moreover Chlorella/Scenedesmus can be grown throughout the year

without cropland.

A number of research works have been carried out on the isolation and production of Chlorella/Scenedesmus in different types of media. The expensive harvesting techniques and drum or spray dry techniques involved made it unsuitable to be used by the farmers of Bangladesh. However harvesting and drying processes can be avoided by growing these algae in a suitable edible culture medium so that the whole product can be fed directly to the ruminants.

With these objectives research was conducted to increase yield and develop a cheaper edible medium so that protein from the algae could be utilised on a large scale.

The result: a system of algal production in an edible medium in artificial mini polythene ponds was developed.

A huge daily yield of 95 tons of algal suspension was recorded under experimental conditions. It cost about \$1.25 (Tk 50) per ton of algal suspension production. The dried algal cells contained 614 g crude protein per kilogram. In a 120 day feeding trial of 8 heifers, each individual animal was given ad libitum urea-mo-

lasses enriched straw with wheat bran. In addition, four animals received daily oil cake rations while the others received ad libitum algal drink (suspension). It was found that the live weight gain of the animals fed on the algal suspension was considerably higher (approximately 20 per cent) than the oil cake group.



Will algae help dairy farms to produce a flood from a trickle?

In addition, Crude fibre digestibility was significantly higher in the algae group (81 per cent) than the oil cake group (76 per cent). These algae, not only as a source of protein, but also in their capacity to increase the digestion of degradable cell wall materials, may be supplied

to a straw diet to create a more favourable rumen environment for straw digestion than the supplementation with the oil cake.

Being a simple technique, with low production costs, and environmentally friendly, in addition to its ability to correct the nutritional imbalances of a straw diet, algae

(Chlorella/Scenedesmus and Pediastrum) may, without doubt, be successfully used for economic livestock production in Bangladesh.

Furthermore, research has shown that these algae are a good source of protein supplement for fish, especially for shrimp fry, and also for poultry.

It must also be mentioned that besides other vitamins, the pro-vitamin A (Beta-carotene), which occurs in significant amounts in Chlorella/Scenedesmus, has been found to be able to retard diseases like cancer, night-blindness and malnutrition (as well as mental depression).

When the livestock wealth in this country improves it cannot fail to influence other relative industries viz. Agriculture, Leather, Sweets, etc. this may well eventually help to bring about the national socio-economic development of Bangladesh.

## Nature or Nurture?

The debate on differences between the sexes has raged for centuries — is it a matter of upbringing and environment or are men and women inherently different in their actions and reactions? Recent research appears to support the latter view — a 'neurobiological explanation' that may shed more light on gender-related differences in behaviour.

It is well known that men and women sometimes behave quite differently. Men for example, often express emotion through physical aggression and women through vocalizing, or men do better at certain spatial tasks and women at some verbal tasks. Now scientists using a special imaging technique have been able to link many such differences to how the brain functions.

A research team at the University of Pennsylvania studied the brain metabolism of 37 men and 24 women by giving them a type of sugar with a radioactive 'tracer' and studying their brain activity through an imaging technique called positron emission tomography, or PET.

The scientists were then able to measure activity by following the consumption of sugar by the brain — the more sugar used, the brighter the image.

The team reported in the latest issue of the journal *Science* that men and women had nearly identical patterns of brain activity except in the area of the brain that controls emotional responses. In this area, men's brains were more active in the primitive parts that stress physical action, while women's brains were more active in parts thought to govern symbolic forms of processing emotion, such as gestures and communication.

"We have known that men and women behave differently in all sorts of ways, and one of the differences most striking is in the way men and women deal with emotions," said Ruben Gur, director of the university's Brain Behavior Laboratory and lead author of the study.

These findings support the possibility that men are more biologically inclined to instrumental means of expression, such as physical aggression, while women are more biolog-

ically inclined to... refined, symbolic means of emotional expression," he said.

Until now, most noticeable differences between men and women — like men tending to do better on math tests and spatial problem-solving, and women having better verbal abilities — had been attributed mostly to learning. There had been little evidence directly linking those differences to brain function.

The findings "support a neurobiological explanation of some sex differences and may help to explain sex-related differences in behaviour," Gur said.

However, although much of the brain's structure and function is thought to be inherited, effects of upbringing and other environmental factors on how the brain works cannot be ruled out, Gur said.

"Automatically, when people hear something is 'biological,' they think it can't be environmentally influenced," he said, "but there is nothing to rule out that this is lifetime conditioning, versus the way people are born."

Gur pointed out that the brain changes under conditioning. Responding to demands, the brain can produce physical changes in blood flow, energy use and the way brain cells behave.

So, whether the differences found in the study were caused by genetics or a lifetime of training "is really a question to which there is no clear answer," Gur said.

In their study, the researchers found that on average men had higher metabolism in the region of the brain called the "temporal limbic system," while women had greater activity in the more highly evolved portion of that system called the "cingulate gyrus."

The limbic system is a deep-brain structure, very old in evolutionary terms, that

humans share with many lower animals. It is primarily involved in emotional regulation. The cingulate region, which lies above and around the limbic components, is a more advanced system involved in emotional processing through symbolic means.

According to Gur, these differences could have had important evolutionary consequences.

"Women are not as strong as men, so being able to read the emotions on the face of a more impulsive stronger half of the species could be very important," he said.

The study also found that women had more active left brain hemispheres, corresponding to their generally superior verbal abilities and verbal memory. Men, on the other hand, tend to have better right-hemisphere abilities such as spatial, mechanical and motor skills.

For instance, men tend to do better in tests in which they look at an object and try to imagine how it will look when rotated. Women do better at such abstract, mental dexterity tests as looking at different shapes, colors and sizes and sorting them out.

The differences also show up in verbal memory, Gur said. "If your rattle off 15 items to get at the supermarket, women are more likely to remember the most," Gur said. "That's explains some of the wifely frustration when the husband comes back and has forgotten some of them. It may be epidemic to his sex."

The study also found that individuals who exhibited brain-function characteristics more typical of the opposite sex were more likely to be men than women, Gur said. This finding may relate to recent surveys showing homosexuality may be more common among men than women.

— Jim Fuller

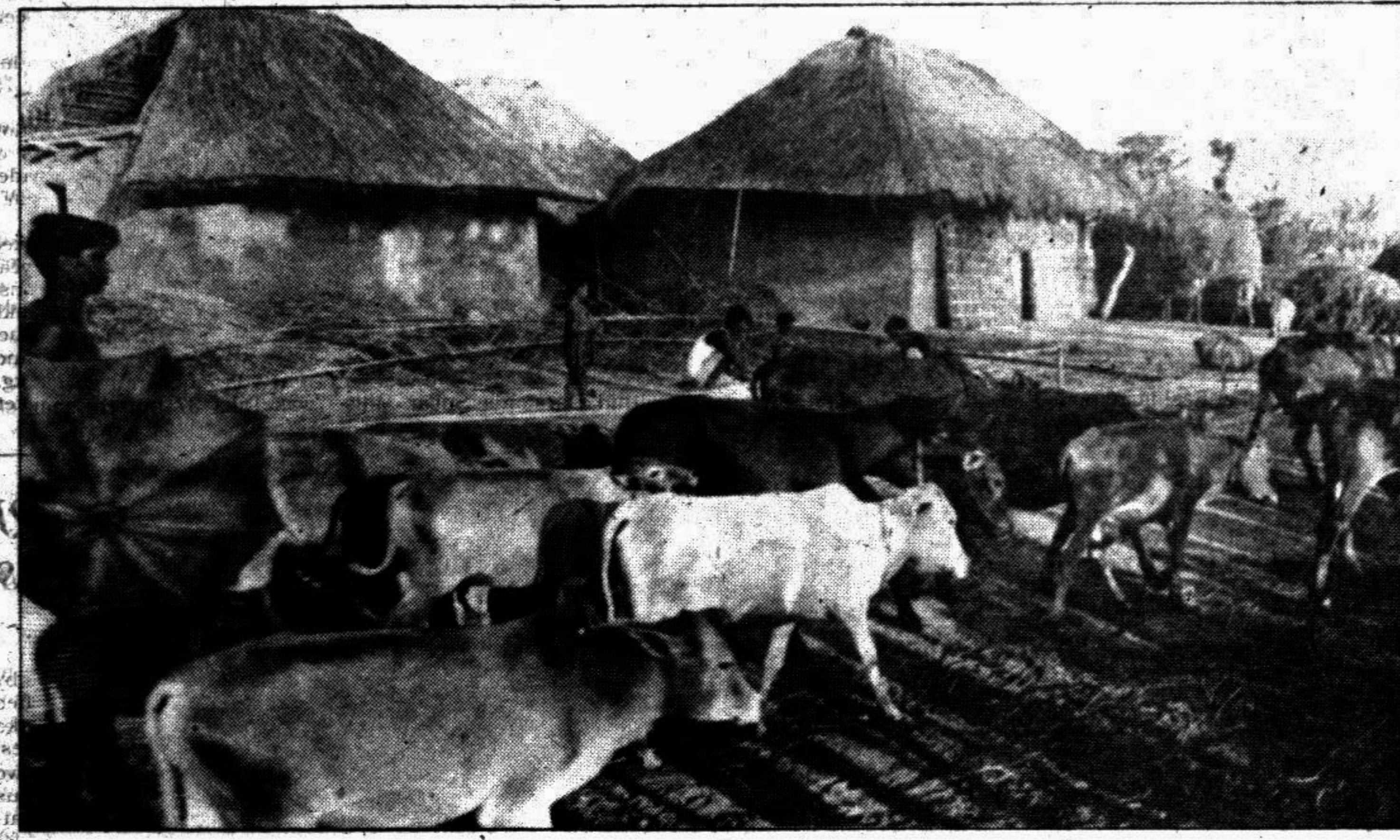


photo by Nozesh Ahmed

## Ancient Remedies Employed in War Against New Illnesses

Medicine's purported triumph over infectious disease has become an illusion'

DESPITE the ready availability of modern medicine, around 80 per cent of the population in Sri Lanka consult traditional healers, according to Dr Jaliya Medagama, secretary of the Ministry of Indigenous Medicine.

Oftentimes, Ayurvedic treatment is sought for chronic conditions for which no "quick fix" medicine is available. This kind of treatment relies heavily on the use of remedies made from herbs and individualized dietary and exercise regimes.

Ayurveda comes from the Sanskrit words *Ayu*, or life, and *Veda*, which means "knowledge" or "science". An ancient medical system that originated in India in the 10th century BC, it combines a study of the physical, mental and emotional aspects of health.

Dr Jipali Palapitaya, director of the Bandaranaike Memorial Ayurvedic Research Institute (BMARI), says the approach is holistic in Ayurvedic treatment. He treats his patients with a combination of therapies involving herbal potions and steam baths, oil massages, acupuncture, music therapy, yoga, meditation and dietary prescriptions.

Ayurvedic theory says a disease is the result of an imbalance in the body's three vital forces: *vata* (which corresponds to the nervous system), *pitta* (the metabolic system), and *kapha* (the body's various fluids).

Some 7,500 Ayurvedic practitioners are active in Sri Lanka today. Of this total, about 3,000 are formally licensed. In comparison, about 23,000 doctors or paramedics received

training from the West.

In a cultural 'rebirth' in 1948 following the end of British rule in Ceylon, as Sri Lanka was then called, Ayurvedic colleges were placed under government sponsorship and numerous Ayurvedic hospitals were established," writes Thomas Larsson in "Choices", the human development magazine of the United Nations Development Programme (UNDP).

In this manner, the centuries-old passing down of medical knowledge from master to student — from father to son, in most cases — was institutionalized and given a modern cloak. In 1980, Sri Lanka's ancient medical remedies were boosted when the government created a Ministry of Indigenous Medicine.

For over a decade now, the UNDP — in close collaboration with the World Health Organization (WHO) — has supported clinical research at BMARI along with the training of its staff.

Training has also been provided to traditional Ayurvedic practitioners to integrate them into primary health care programmes at the village level, stressing preventive measures such as immunization.

"There is no doubt that traditional medicine includes treatments, even cures, for many afflictions, and that most Sri Lankans consult traditional practitioners frequently throughout the course of their lives," observes Robert England, UNDP resident representative in Sri Lanka.

For a start, UNDP is helping to preserve Ayurvedic wisdom that is at risk of disappearing. Although traditional practi-

tioners tend to keep their knowledge secret, a wealth of information has already been compiled.

"Modern medicine could benefit tremendously," says P B Weragoda, who manages the UNDP-funded project.

In the 1960s, medical experts predicted that infectious diseases would be a memory by the turn of the century. In fact in 1969, an American Surgeon General told the United States Congress: "The time has come to close the book on infectious diseases."

This pronouncement was followed by drastic cuts in research budgets and medical students were discouraged from specializing in such illnesses.

But victory over infectious diseases still remains a distant goal five years before a new century. In fact, Dr Sherwin Nuland in his best-selling book *How We Die* writes, "medicine's purported triumph over infectious disease has become an illusion".

Far from vanquishing old enemies, drug-resistant strains of the ailments are appearing even as brand new illnesses with no known cure are also breaking out.

Most medical scientists are very much worried that terrible new diseases, following the pattern of Acquired Immune Deficiency Syndrome (AIDS), will develop soon. Some 50 viruses have already been identified which were previously unknown to medical science.

As the world continues to battle old and new diseases every weapon with potential is being employed including ancient cures. Traditional medicine has gained credence

due to popular interest in alternative medicine in the West and the discovery of chemical substances in plants that may hold the key to future treatments for diseases like cancer and the dreaded AIDS.

"Among international organizations, it was not until the 1970s that the possible value of traditional medicine was explored," recalls Dr Judith Justice, a professor of medical anthropology at the University of California in San Francisco.

In 1978, WHO and other UN bodies adopted the goal "Health for All by the Year 2000". To make this happen, governments started to include aspects of traditional medicine in the design of their national health care programmes.

China's model of 'barefoot doctors' provided a prototype for various primary health care schemes involving traditional practitioners and birth attendants.

"Beginning in the 1970s, UN and non-governmental organizations supported such models to strengthen delivery of health services primarily to rural areas," says Dr Justice, who once worked as a UNDP consultant in Sri Lanka, Indonesia and Myanmar.

In some cases, the focus was on training traditional practitioners to qualify as community health workers and thus encourage their integration into primary health care programmes.

In other cases, referral systems were created between traditional practitioners, who are widely patronized in rural communities, and Western-trained doctors and paramedical personnel. — *Depthawes Asia*

## The Sky's the Limit as Airlines Head Down

by Mick Hamer

"GOOD morning. This is your captain speaking. Welcome aboard today's flight. Our cruising speed is 500 miles or 800 kilometres per hour and we are flying at our normal height of 15 feet, or 5 metres."

It sounds like science fiction. But it is not. A prototype aircraft that skims along only a few metres above the water has already been developed by scientists working in the former Soviet Union and was tested on the Caspian Sea in the 1980s.

Now the College of Aeronautics at the Cranfield Institute of Technology in Britain is interested in turning the idea into a commercial proposition. It has been talking to the Russians about the research since 1992. College spokesman John Parker says of the plane: "We are talking about getting one."

The plane, known technically as a ground-effect aircraft, was developed in the city of Gorky in the early 1980s by the Central Hydrofoil Design Bureau. The first news of the plane came from spy satellite photographs of the tests on the Caspian Sea.

The principle behind the ground-effect aircraft is relatively simple. When an aeroplane flies very close to the ground it traps a cushion of air under its wings. The plane floats on this air cushion, re-

ducing the engine power needed to keep the aircraft in the air, cutting aerodynamic drag and enabling it to cut fuel consumption by 20 per cent, according to the Russian tests.

Flying as close as five metres to the ground is really practical only over stretches of relatively smooth water, which is why the Russians chose the Caspian Sea as a test-bed.

The most likely commercial use for a ground-effect plane is as a replacement for hydrofoils, hovercraft and high-speed catamarans. Unlike these craft, the ground-effect plane would be able to avoid ships in its path by simply soaring above them.

Saving fuel is one priority; another is to find ways of increasing the capacity of aircraft to cope with ever-increasing demand.

A great deal of design thought is going into this problem, and with the number of passengers set to double over the next 15 years, Lloyd Jenkinson of the aeronautical engineering department at Britain's Loughborough University of Technology says that the answer could be for planes to fly in formation, like flocks of geese.

The obvious solution to the spiralling increase in passengers, says Jenkinson, is to build planes that are twice the size of existing airliners. But international air safety regulations lay down that in an emergency planes have to be evacuated in 90 seconds.

Although it is not difficult in principle to design a double-sized jumbo jet, carrying nearly 1,000 people, it is difficult to design a plane that can meet the evacuation requirements, says Jenkinson.

Jenkinson's first solution to this problem was to design a

double-hulled plane — two jumbo-sized fuselages connected by a fixed wing. However, he quickly realised that the link between the two did not have to be mechanical. "Suddenly we said: 'Why not make that link not structural but electronic?'"

Modern aeroplanes are already flown from one airport to another by computer. The pilot is probably in control of the plane only during take off.

Jenkinson envisages two jumbo-sized planes flying a quarter of a mile apart, one diagonally behind the other. The planes' on-board computers would automatically maintain this distance between the two planes.

The lead plane would be responsible for keeping the two aircraft on course while the slave plane would simply follow the leader. Both aircraft, says Jenkinson, would still have crews, in case of an emergency.

Jenkinson says that research would be required to prove the safety of the electronic link between the two planes. He argues that it is merely an extension of the flight control system in use today. One of the other advantages, says Jenkinson, is that the planes would save fuel. He says that aerodynamic tests have shown that formation flying cuts an aircraft's fuel bill by 10 per cent. — GEMINI NEWS

**Milestones in the air**

- Largest airliner: Boeing 747, carries 567 passengers
- Biggest passenger load: 1,087 by a Boeing 747 in 1991 when Ethiopian Jews were evacuated from Addis Ababa
- Fastest airliner: Concorde, first flown in 1969, cruises at 2,333 km per hour
- Longest non-stop scheduled flight: Johannesburg to New York, 12,847 km