burn animal manure and crop-residues, thus depriving the soil of these sources of humus and plant-nutrients. This not only results in poorer crop-yields, as would be expected, but also reduces the plants' ability to withstand drought conditions, an ability which is closely related to the availability of nutrients in the soil. So in a marginal climate a drop in soil fertility will often lead to complete crop failure.

While there is no doubt that vegetation ground cover, especially trees, favourably influence the micro-climate, little exact information is available about possible effects on the macro-climate. Do such phenomena as higher day and lower night temperatures on denuded land, and an increase in the amount of dust in the higher atmosphere over overgrazed and overcultivated land, result in reduced rainfall? We really do not know in a scientific way. We only suspect that it is so. Not knowing for sure, we give the trees the benefit of the doubt and advocate the afforestation of dry areas. It may lead to better rainfall, or it may not. It will at least improve the micro-climate, and that in itself would be very valuable.

We have considered the importance of trees for the physical environment, the environment on which our supply of food and many other material goods depend. However, man does not live by bread alone. Human fulfilment also depends on a less tangible quality in our environment which we call beauty. Trees with attractive foliage and fragrant flowers around dwellings enrich the lives of those living in them and at the same time protect them against sun, wind and dust. Green belts around towns serve a similar purpose and provide leisure areas where people can escape the hustle and bustle, and fumes and stress, of modern urban life.

Trees may thus provide not only some of man's most basic physical requirements, but for some of his mental needs as well. The role of the tree in Africa is to contribute to the maintenance of an environment that is friendly to both man and beast. □

Elephant grass is good for cows . . .

Alexander Dorozynski

Although Egypt has some of the most productive agricultural land in the world, the country is suffering from an acute shortage of meat and animal products. The reason is a corresponding shortage of cattle feed, particularly during the dry summer months. This has resulted in the diet of the average Egyptian being among the lowest in the world in terms of animal protein.

A major effort is now underway, however, to remedy the situation, and three research projects appear to be particularly promising. Two of these projects are geared to the utilization of by-products that are at present either under-utilized or completely wasted.

The country's four main crops — cotton, corn, rice and sugar — yield more than 8 million tons of by-products: some 2.5 million tons of corn stover, 2.1 million tons of cotton stalks, 1.5 million tons of rice straw, as well as cotton seed hulls, corn cobs, rice hulls, sugar cane bagasse and molasses.

At present none of these is used in the production of pelleted feed, which relies principally on the limited availability of one major ingredient, cottonseed cake. Yet, these by-products are potential sources of feed — provided they are processed, and introduced, in the right proportion, in feed formulas.

This is the goal of a research project now underway at the Faculty of Agriculture of the University of Alexandria. The project is being carried out by the Department of Animal Production, with the support of IDRC.

In a series of laboratory experiments the researchers have developed physical, chemical and microbiological processes to improve the digestibility and nutritive value of the by-products. Feeding trials have indicated that the processed by-products can be used as components of pelleted food in proportions of about one-third, perhaps even more.

Dr Khaled El-Shazly, project leader and head of the Department's animal nutrition unit, and Dr A.R. Abou Akkada, principal investigator, are both members of the eight-man Animal Production Commission, responsible for government policy on livestock. They work in collaboration with the High Commission on Animal Feed, with the aim of devising feed formulas for specific requirements such as milk production, beef, sheep, and poultry, that can be adapted to make best use of local availability of by-products.

The nutritive value of several feed formulas has been tested in the laboratory. Feeding trials have given good results and work is now underway to establish a semi-industrial pilot plant capable of producing about one ton of pelleted food per hour. This plant is expected to be operating by the end of the year. The ultimate goal is the establishment of a number of small-scale local plants, down to the scale of cooperative farms, some of which are participating in the project.

Experiments are continuing at a small research station near Alexandria to improve the quality of by-products. Processing methods include chopping, milling and steam treatment, chemical delignification, and microbiological treatment. The latter involves ensilage, use of lignin-dissolving bacteria, and

Photo: A. Dorozynski

Dr Makky (centre), director of the Animal Production Research Institute in Cairo, views cattle feeding on elephant grass with one of the farmers participating in the project.

of fermentors. One research group has already developed a simple and effective treatment using ammonia and acetic acid, that could be applied by ordinary farmers. These experiments are also followed by feeding trials.

Dr El-Shazly, and Dr Akkada believe that this project could lead to the production of 2.5 million tons of pelleted food per year, the estimated "maintenance ration" for the country's livestock. Actual production of pelleted food at present is about 800,000 tons per year. Small production plants, says Dr Akkada, could be set up at relatively little cost, and larger farms could have their own.

This research has attracted the interest of the Arab Organization for Agricultural Development and of several African countries that could take advantage of similar utilization of agricultural by-products (for instance, huge amounts of groundnut hulls in Sudan, whose researchers have visited the Alexandria project). Plans are underway to offer courses to students from other Arab countries beginning next year.

At the same time, researchers in Alexandria, with the support of the U.S. Department of Agriculture, are exploring another way of increasing feed production, through the utilization of by-products of the food canning industry, which is chiefly concentrated near Cairo and Alexandria. Collecting garbage from a number of Alexandria's restaurants was a part of this approach. Indeed it was found that garbage, once sorted and ground-up, constituted a complete poultry ration, with a high protein content of 22 percent. This is not surprising, notes Dr Akkada, since poultry started as a "backyard industry", with chickens being fed mainly with the farmer's waste.

Another research project also aimed at increasing animal production is being undertaken by Dr A.M. Makky, director of the Animal Production Research Institute at the Ministry of Agriculture in Cairo, also with the support of an IDRC grant. His idea is to introduce elephant grass, native to Uganda, as an additional source of summer forage, which is now in very short supply.

At present, points out Dr Makky about 80 percent of the agricultural land in Egypt is devoted to five crops: cotton, wheat, clover, corn and rice. The rest is used to grow sugar, onions, vegetables, fruits and other secondary crops. In spite of the high productivity of the land there is a shortage of animal production and one of the major reasons for this shortage is lack of summer forage. In the winter period, says Dr Makky, clover covers 95 percent of the animals' requirements, but no forage is grown in summer, so that cattle are kept on wheat straw, strippings of corn leaves, wheat and rice bran, and cottonseed cake concentrate. There is, points out Dr Makky, a shortage of more than 3 million tons of starch equivalent, equal to about 6 million tons of cottonseed cake or 4 million tons of corn grain.

The research project, undertaken with nutritionist M.K. Hathout, shows that additional summer forage could be grown by introducing new forage crops in such a way as not to disturb the farm economy. Elephant grass (*Pennisetum purpureum*), also known as Uganda grass, is a good candidate, and it is being introduced experimentally in a kind of musical chairs game in which crops are moved around in such a fashion that the net productivity balance of the land is increased.

Say that in a farm where rice, corn, wheat, cotton, clover and secondary crops are grown, one hectare is used to grow clover in the winter, and corn (or corn and rice) in the summer. Dr Makky and his team calculated that a net gain could be obtained if half of that hectare was permanently devoted to elephant grass, productive in the summer but dormant in the winter. The other half will be used, in summer, to grow corn, and in winter, to grow additional wheat to compensate for the loss of grain from the half now occupied by elephant grass. That area devoted to elephant grass will nevertheless continue to produce clover in the winter.

Research has shown that elephant grass can be cut up to 10 times during its growing season. It should be cut after it reaches the height of one metre (not more, as it then becomes lignified, too tough and indigestible). A hectare of land can thus yield up to 120 tons of elephant grass, as well as clover in the winter. The system results in increased total production (and increased total income). According to Dr Makky, additional animal feed estimated at more than 5 million tons of starch equivalent could be produced in Egypt. An economic study indicates that this new crop system could lead to a total gain in cash value exceeding 150 million Egyptian pounds, and even more once this forage is converted to milk and meat.

Elephant grass growing in odd plots around the Ministry of Agriculture building in Cairo is an unexpected sight in this crowded city. It was planted there when the study of different germ plasms and of other summer forage, was started. Now several hectares of elephant grass have been planted in an experimental station 80 km. north of Cairo, where nutrition, metabolism, and milk production trials are underway. The new crop system must then be tried out on farms to make sure that the "musical chairs" game can be kept going year after year, and that the elephant grass is gathered at the right time, lest its productivity declines and there is insufficient coverage to protect against weed invasion. Five or six farmers have been provided with clumps of elephant grass. All of them have been able to provide additional forage to their cattle, and say they intend to continue growing it in the future.

Preliminary results last summer showed that milk productivity of cows fed with elephant grass alone is as high as that of cows fed with other forage grasses or with a mixture of grasses, clover, and pelleted food. It is certain, says Dr Makky, that the high productivity of elephant grass can considerably increase the meat production per hectare — perhaps even double it.

The elephant grass project has also been approved by the Ministry of Agriculture. Put together, all of these research projects may go a long way towards reducing the shortage of meat and animal products in Egypt. □