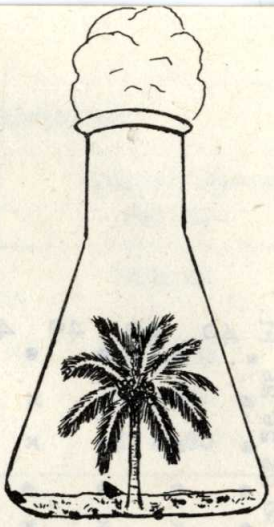
TISSUE CULTURE TOWARDS BETTER COCONUT



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Plant tissue culture can be defined as a technique of culturing plant parts such as cells, protoplasts (cells with cell walls removed), tissues from various parts of the plant organs (shoot, root tips, tender leaves, flowers etc.), pollen and embryos in a nutrient medium under strictly aseptic or microbe-free conditions. The resulting plant or a group of plants being a clone is often expected, though may not always, to be identical to the mother plant. In addition to cloning, the technique is also used as the only and sometimes the preferred method of achieving a number of other objectives in agriculture. Some of these objectives are development of new species of plants, production of disease-free and disease-resistant plant material and preservation of plant parts in a viable condition and subsequent regeneration of entire plants when required (instead of the costly replanting cycles in the field).

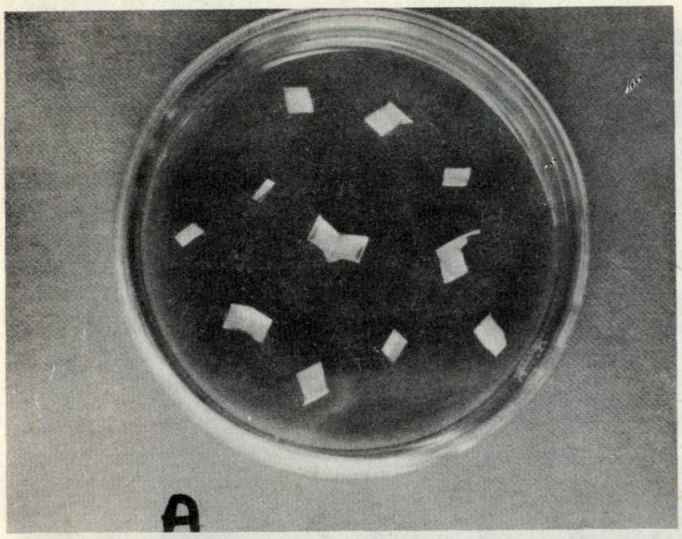
Cloning is a technique by which identical plants are produced in large numbers using tender plant parts other than the conventional seed. Therefore, clonal plants resemble very much the mother plant and tend to be uniform in all their characters such as flowering pattern, yield and other desirable (and undesirable) traits, in contrast to a population of seed-derived plants. Because of this uniformity, clonal plants of superior cultivars are always preferred over the improved but seed-derived plants.

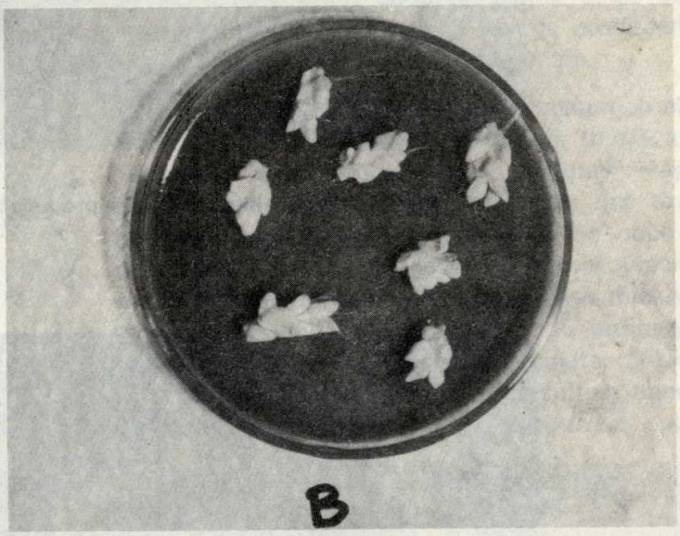
Cloning of many agriculturally important plants can be performed successfully and economically in the field or in the green house using the vegetative propagation methods. However, when the plant response is not favourable, a laboratory technique has to be developed for cloning. Coconut is a very good example to illustrate this. Coconut planting material is produced exclusively through seed and therefore the variation in a population is unavoidable. It is a palm having only a single growing point and cannot be propagated by vegetative methods. The plant regenerating capacity of coconut tissues has therefore to be tested in the laboratory, using tissue culture technology.

For coconut tissue culture, very small pieces (2×2 mm) are removed from tender leaves, flowers and growing point (Fig. 1) and nurtured in especially formulated nutrient media under microbe-free conditions, to prevent spoilage of tissues and the culture media. Under these conditions plant cells lose their specific functions and revert to the simplest form. These cells when treated appropriately, follow a completely different pathway to produce embryogenic or "seed like" structures (Fig. 2). The 'seeds' thus produced from the vegetative tissue of the plant germinate (Fig. 3) to produce plants (a clone) identical to the mother plant from which tissues have been removed.

Coconut Embryo Culture

Embryo is the seed proper or the rudimentary plant developed within the nut as a result of natural/controlled pollination. (Fig. 4A, B). Under conditions favourable for germination, the embryo sprouts utilizing the food resources in the nut. In the embryo culture technique, the embryo is removed from the nut and induced to germinate in an artificial medium under microbe-free conditions to form a plant (Fig. 4C, D).





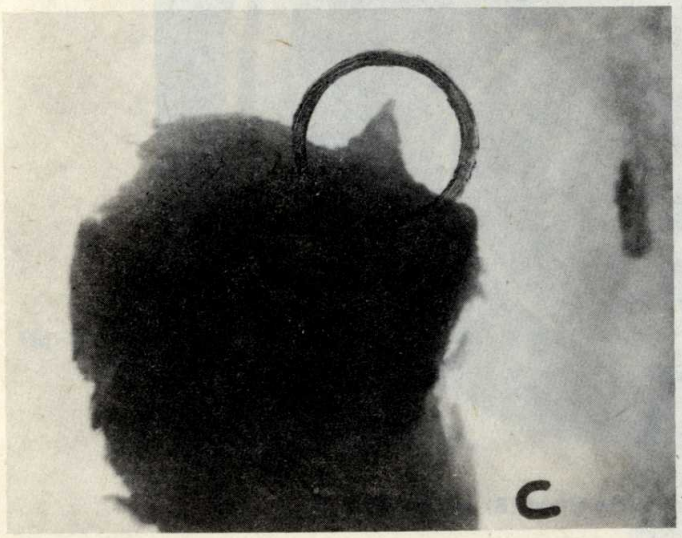


Fig. 1 Culture materials of coconut
A. Leaf tissues
B. Tender flowers
C. Growing point

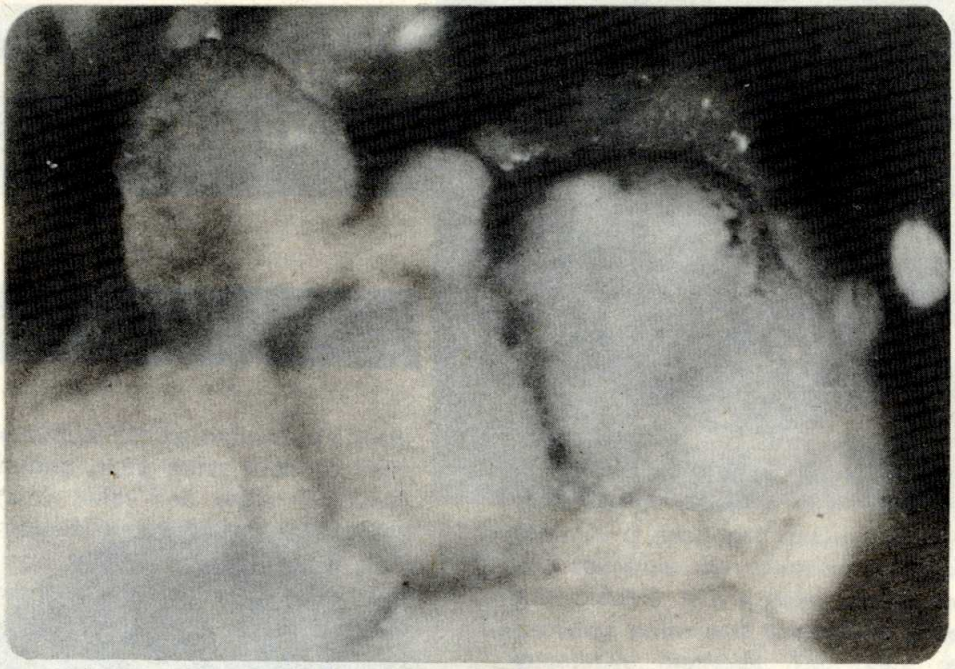


Fig. 2 "Seed"–like structures produced from a cultured leaf tissue.

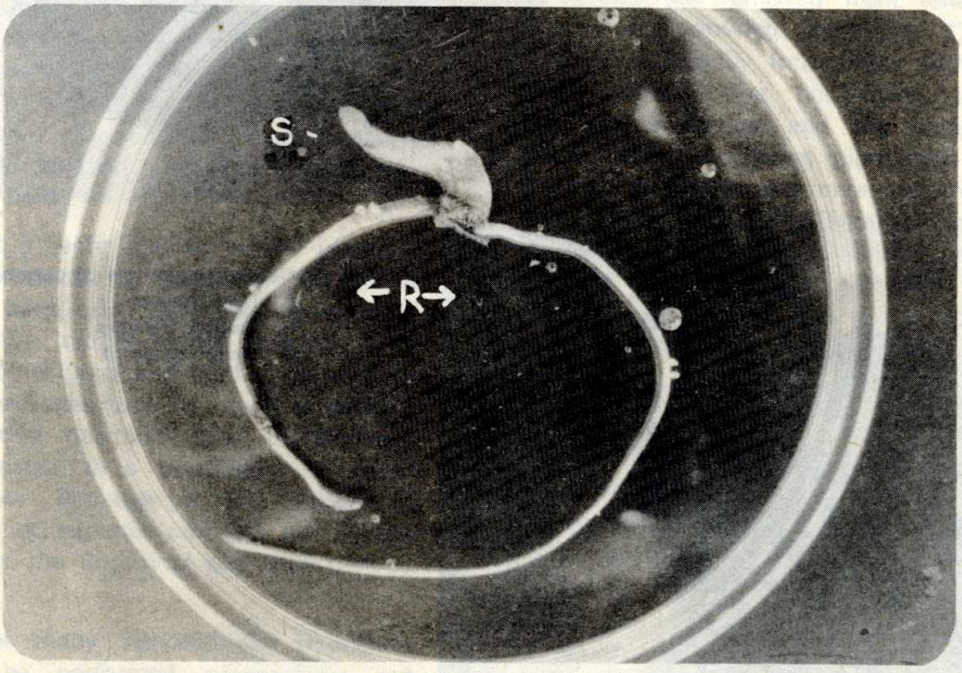


Fig. 3 A sprouted "seed", note the shoot (S) and the root (R).

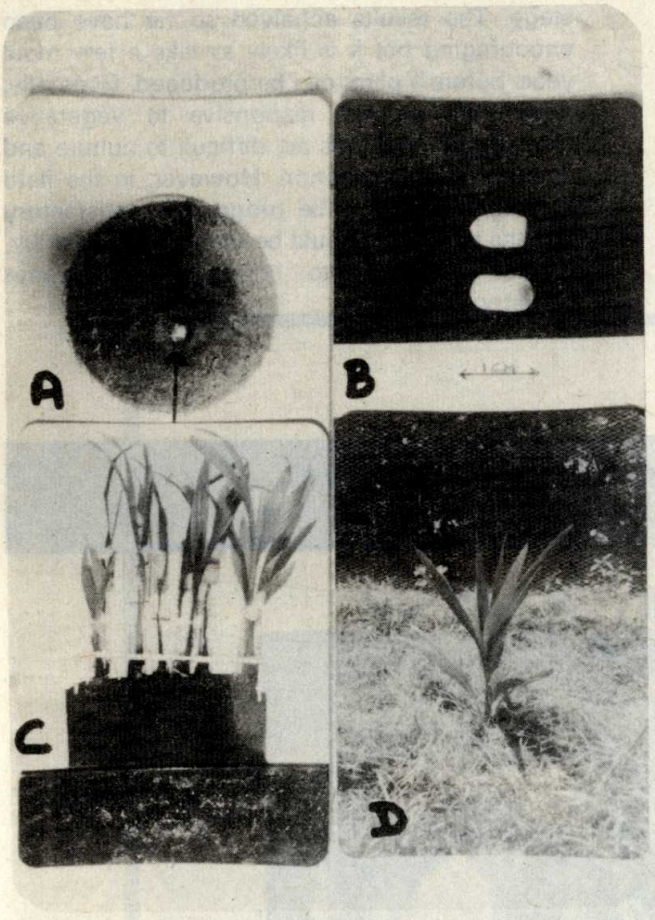


Fig. 4 Coconut embryo culture
A, B. Embryos
C. Plants developed from embryos
D. Embryo-cultured plant in the field

Embryo culture technique can be utilized successfully in a few areas of coconut research. Import of disease-free coconut seed material, with minimal transport cost is now possible using this technique (Fig. 5). The technique is currently being used in a programme of selecting drought tolerent coconut palms. Plants are raised from embryos in a culture medium supplemented with 'drought inducing' chemicals at sufficiently high levels. These chemicals inhibit the movement of water into plant tissues but exert no direct detrimental effect. During the course of development in culture, the sensitive plants perish early but the drought-tolerant plants, with little available water, continue to grow. The efficacy of using embryo culture technique for this investigation is that several thousands of coconut 'palms' could be tested in the laboratory and results produced within a short period of about 2 years.

Another area of interest is the propagation of *Dikiri pol.* This variety is commonly found in Weligama area. In such trees, a bunch may contain one or two *Dikiri* coconuts, but the rest would be ordinary coconuts. *Dikiri* coconuts have a semi-solid, jelly like kernel which has a high oil content. The shell is also thicker than in ordinary coconuts. Although ordinary coconuts from a *Dikiri* tree germinate, *Dikiri* coconuts do not germinate. The resulting trees will have bunches with occasional *Dikiri* nut.

Fig. 5 Transport of 8 "seed nuts" in a 10 cm diameter dish containing the nutrient medium.

It has been possible to produce plants of *Dikiri pol* using the embryo culture technique. The plants, on maturity, should produce only *Dikiri* nuts.

Tissue culture research commenced at the Coconut Research Institute recently with the objective of developing methodologies for clonal propagation of superior cultivars of coconut is very much at the experimental stage. The results acheived so far have been encouraging but it is likely to take a few more years before a plant can be produced. Generally, trees that are not responsive to vegetative propagation methods are difficult to culture and coconut is no exception. However, in the field of embryo culture, the progress is satisfactory and the technique could be utilized successfully, where necessary, to improve the coconut industry.

Historic Day for the Coconut Research Institute

For the first time in the history of the Coconut Research Institute, a presentation of memorial plaques to officers who have rendered twenty five years of continus service, took place on the 17th March 1987 at the club house of this Institute.

The Hon. Minister of Coconut Industries Mr. Harold Herat graced the occasion and gave away the plaques.