High-Tech Solution Helps Nut Farmers

The production of subtropical fruits and nuts, in this picture macadamia nuts, is to a large extent weather dependent.

If you are involved in "farm-truthing" and updating a computer routine intended to provide real-life practical but scientifically founded estimates of crop irrigation requirements and you receive an appreciative telephone call from a hard-bitten, well-informed agricultural consultant it means a great deal. Charles Crosby reports.

Agricultural consultants are playing an increasingly important role in agriculture in South Africa. They are generally part of the community they serve and consequently in close touch with the needs of their clients. Some are generalists and are particularly well informed about those little things that make such a difference in farming today. At the same time they have the background and ability to access specialist knowledge when this is required. Clients relatively inexperienced in the new technologies are best served by monthly visits during which comprehensive guidance can be provided. Well-established clients turn to the consultants for high-tech solutions when unexpected difficulties are encountered. The consultants are usually participants in the activities of grower associations and local study groups, and are in touch with the specialists in South Africa and overseas through personal contact and the Internet.

WHERE AND HOW DO CONSULTANTS LEARN THEIR TRADE?

While no two consultants will have followed the same path there does seem to be a degree of similarity. The career of Dries Alberts an agricultural consultant, based on Levubu, Limpopo Province, is a good example.

Alberts started at the Roodeplaat Horticultural Research Institute in 1966. During his ten-year stint here he made his first contact with macadamia nuts during this period. He was then transferred to be officer in charge of the Levubu experiment station of the Citrus and Subtropical Fruit Research Institute, Nelspruit, for a further ten-year stint. His next move was to Levubu cooperative as agricultural extension officer where he worked directly with the farmers.

This was about the time when private companies were formed to take over many of the production, input supply and marketing functions of the cooperatives, and Alberts moved across to a company as technical officer for a further four years. The farmers who had come to reply on him for information and advice pestered him to become a private agricultural consultant.

He enjoyed the challenge and down the years has extended his field of knowledge to cover all the facets of farming in the area, including the development of business plants, labour and legal aspects and the handling, packing and transport of products. He has taken the lead in developing integrated pest management (IPM) for SAMAC, the macadamia grower association, and this initiative has led to the establishment of a national forum.

SUBTROPICAL FRUIT AND NUT PRODUCTION AND THE FIVE-DAY WEATHER FORECAST

The production of subtropical fruits and nuts is to large extent weather dependent. These crops are produced under irrigation so that the atmospheric demand as well as the availability of rain and stored water is largely determined by weather. In addition atmospheric conditions can have a significant influence on the incidence of pests and disease. An additional complicating factor is that in the northern provinces we are dealing with a pattern of largely unpredictable summer rainfall and wide swings in the climatic factors that influence crop growth and this has a material influence on irrigation management.

To the uninitiated it is almost unbelievable that the farmers are not only informed on what day and at what time it will rain, but also how many millimetres can be expected.

It is not surprising that one of the important services provided by Alberts to his clients is the five-day automatic weather station-based weather forecast managed by Dacorn, a Netherlands-based company represented in South Africa by CropSystems. A dedicated automatic weather station at Levubu, one of 800 weather stations worldwide in the Dacom network, measures temperature, relative humidity, and solar radiation and wind speed every 15 minutes and transmits the data to the Netherlands.

Agricultural consultant Dries Alberts. Agricultural consultants are playing an increasingly important role in agriculture in South Africa.

Dries Alberts advising a client.

This is an Internet connection via a conventional telephone line. The data is processed to develop a five-day weather forecast with an interval of four hours as well as an indication of likely disease and insect problems. Alberts consolidates this information and twice a week e-mails the forecasts, with recommendations, to his farmer clients.

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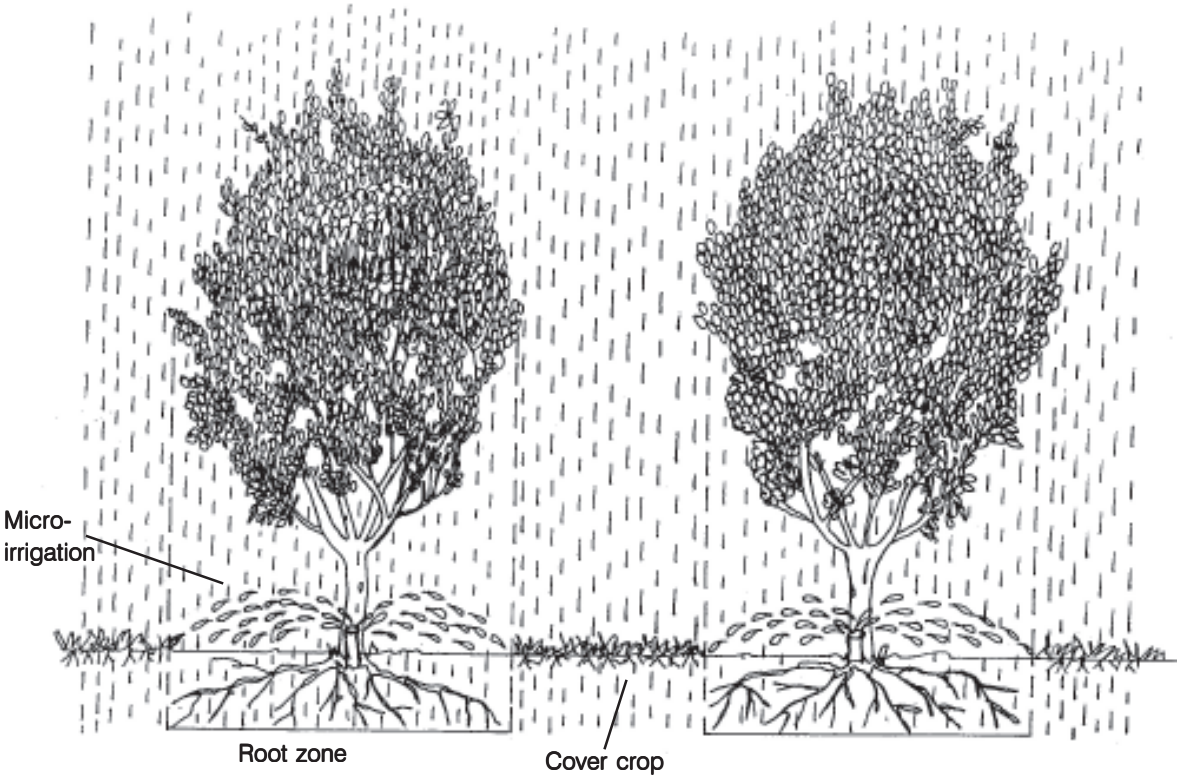
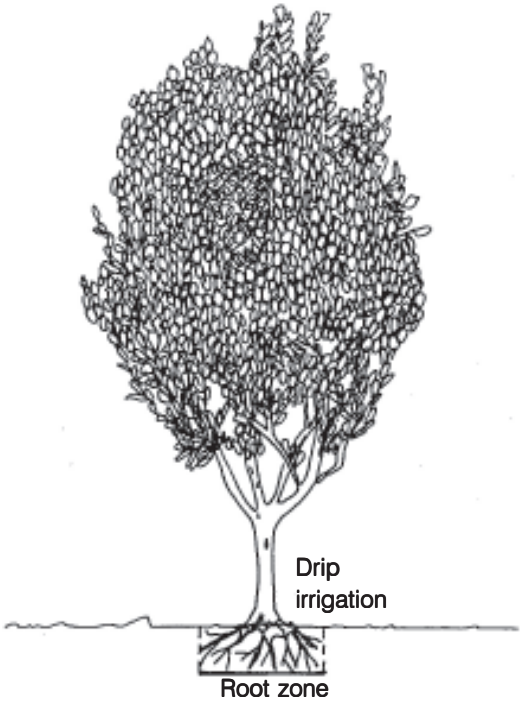


Conventional irrigation – canopy cover 70%, irrigated area and root zone 70%. Rain augments irrigation in summer.



Open hydroponics – canopy cover 70%, irrigated area only 10% – concentrated root zone. In spring no rain, only irrigation.

In summer, do the "outside" roots develop and contribute to the irrigation requirements of the tree?

THE IMPACT OF RAIN ON THE IRRIGATION REQUIREMENTS OF SUBTROPICAL FRUIT AND NUTS

Normal practice when estimating the crop irrigation requirements of subtropical fruits and nuts is to assume that the trees are mature and that the canopy drip line demarcates the area wetted during irrigation and the extent of the active root zone. When estimating crop irrigation requirements for design and planning purposes rain has a major impact during the summer months because rain falling on the canopy will find its way to the soil surface and augment irrigation. Indeed, in a high rainfall area such as Levubu, summer irrigation could be redundant in an exceptional year! This would, however, not be the case in September or October when the evaporative demand is high and the spring rains are still on their way, then the trees will be totally dependent on irrigation. Sapwat appears to be adequate for estimating both this peak system capacity, and the annual water requirement taking rain into account.

informed on what day and at what time it will rain, but also how many millimetres can be expected. They are given early warning notice as to what pest and disease problems are threatening, and when wind and humidity conditions will make spraying possible.

Alberts has gone even further and added plant stress and fire danger indices as well as irrigation advice.

IRRIGATION, THE SAPWAT MODEL AND THE "ANOMALIES"

Alberts finds the Water Research Commission initiated program SAPWAT useful when he visits with a client discussing irrigation and how it fits in with farm management and production. One of the reasons for this is that there is nothing vague about SAPWAT. Once the weather station, crop, irrigation method, and soils have been selected and a real-life crop production and irrigation strategy developed, the model should produce estimates of monthly and seasonal irrigation water requirements that are in line with what the client experiences in practice. If there are anomalies it should be possible to backtrack and check the appropriateness of inputs and make the necessary corrections. Of course the client's perceptions of irrigation water use are by no means above suspicion! Still it should be possible to reconcile and explain the differences.

Alberts first detected an anomaly when he compared SAPWAT output with the readings he was obtaining from a line of mature Macadamia trees where he was monitoring soil moisture content under the dripper line. His trees were not using nearly as much water as SAPWAT had prescribed. His set up approximates that of a drip irrigated orchard managed on the "open hydroponics" principle where the drip-irrigated area is only about 10% of the orchard area. The feeder roots are concentrated in this area and the plant nutrients are provided in accurately metered quantities through the irrigation water. Because the volume of the root system is limited it is also normally necessary to apply pulse irrigation to replenish the water content several times a day. The process is computer-controlled. In the spring when the trees are almost totally dependent on the irrigation water the system must be designed to cope with this peak demand. Consequently rain is left out of the calculation.

But can one afford to ignore rain in a high rainfall region? Fortunately, the method of managing the irrigation is self-compensating. When the water content of the profile under the dripper line reaches a predetermined level irrigation takes place and brings that water content back up to field capacity.

In the spring, assuming no rain, all the water required by the plant must be supplied through irrigation. In the summer months some of the water will be provided by rain and the demand on the irrigation system will automatically be less.

If, however, the wetted area is only 10% of the orchard area then it will only be 10% of the volume of water provided by the rain that will be utilised. That is assuming that it is only the active irrigated roots that will be tapping water. For all we appear to know, roots outside this active zone may be finding water for themselves in the rainy season.

In practice, at a management level, none of this is all that important in the irrigated area provided the irrigation system has adequate capacity and the water content of the soil is accurately measured and controlled. Where it is a factor is in developing figures for the total volume of water required for the season's irrigation. In an area with high rainfall such as Levubu this is probably not an important factor, but it would be in the Karroo. It would also be important when developing best management practices and arriving at realistic figures for crop irrigation requirements for catchment management and licensing purposes.