

Using the NutriLOGIC program

The N fertiliser requirement of cotton can be predicted from pre-sowing soil nitrate and/or cotton petiole nitrate analyses. This is the basis for the NutriLOGIC program.

In determining the N fertiliser requirement, the program takes into account:

- Soil factors (texture, compaction and predisposition to waterlogging);
- The district in which the cotton will be growing, as hotter (longer season) areas require higher N rates to maximise lint yields; and,
- The time the soil or petiole samples were collected

About NutriLOGIC

NutriLOGIC is a user-friendly decision aid for nitrogen fertiliser management.

It is a component of CottonLOGIC, a computerised decision support system developed by the CSIRO and Cotton CRC, to provide the cotton industry with access to the latest research.

NutriLOGIC allows growers to interpret their pre-sowing soil nitrate analyses to indicate the N fertiliser requirement of their fields before the cotton is sown. It

provides growers with a means of identifying N deficiency cotton crops based on petiole nitrate analyses. It also contains information on critical levels of all nutrients in soil and plant tissues.

The calibrations within the NutriLOGIC program were derived by Dr Greg Constable and Dr Ian Rochester at the CSIRO Cotton Research Unit, Narrabri.

The program predicts the economic optimum N fertiliser rate based on the cost of N fertiliser and the price received for cotton lint. Soil or petiole nitrate levels, regional yield responses and sampling time are the main inputs of the program.

What is the economic optimum N rate?

Economic optimum N rate is the N application rate where the cost of applying one additional unit of fertiliser equals the return from the lint produced from that additional unit of fertiliser input.

The NutriLOGIC program predicts the economic optimum N fertiliser rate, according to the typical N response curve (Figure 1).

Because the cost of applying N fertiliser is relatively inexpensive, compared with the return per kg of lint, the

economic optimum N rate is usually very close (often only 5–10 kg N per hectare less) to that needed to produce the maximum yield. If fertiliser prices were to escalate, or if cotton prices were to fall dramatically, the economic optimum yield would be appreciably lower than the maximum yield.

Soil nitrate-N analysis

Soil samples can be collected between July and September and analysed for nitrate-N. NutriLOGIC produces an indication of the N fertiliser required by each field (soil sample) based on the nitrate-N concentration from the soil analysis.

Three parameters must be entered into the data entry screen:

- Soil nitrate-N (ppm=mg N/kg — nitrate analyses performed by a specialist laboratory);
- Soil type (indicative of soil texture, compaction, drainage);
- Regional data (recognised through the CottonLOGIC farm set-up, which is a necessary step before using NutriLOGIC).

NutriLOGIC suggests N fertiliser application rates assuming the soil samples have been taken from 0–30 cm depth in an irrigated production system.

NutriLOGIC will modify the N fertiliser rate according to the month the soil samples were taken. NutriLOGIC contains no calibration for soil sampled earlier than July or later than September.

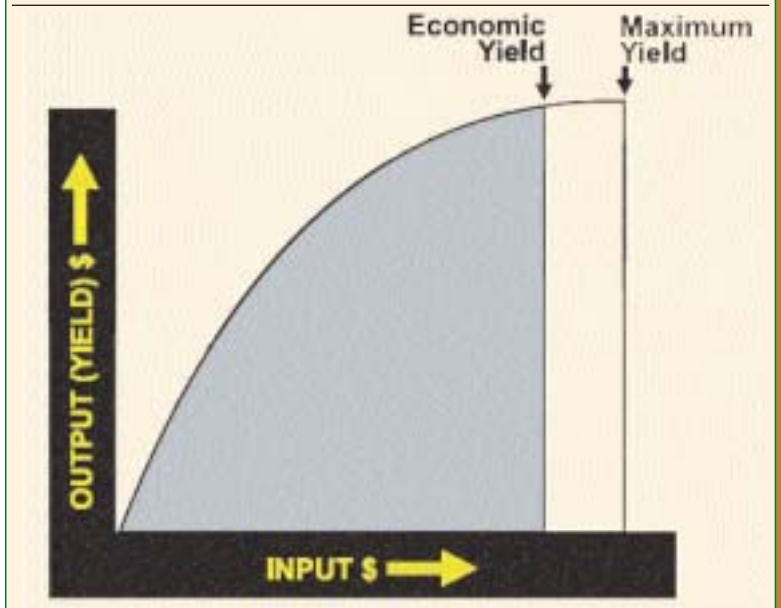
An example of a NutriLOGIC calibration is indicated in Figure 2, where the suggested N fertiliser application rate declines with increasing soil nitrate-N.

Soil textural classes are somewhat arbitrary, but make allowance for better N fertiliser use efficiency and better drainage in lighter textured soils. Loamy clays and light clays constitute the better soils. Medium clays (most grey clays) constitute the average soils used for cotton growing. Heavy clays (black earths and heavy grey clays) present more problems with drainage, waterlogging and poor N fertiliser use efficiency.

Petiole nitrate-N analysis

Petiole analyses are performed on cotton crops from squaring to midflowering.

FIGURE 1: A typical N response curve showing the proximity of the economic optimum N fertiliser rate and the N rate producing the maximum yield



The program requires the input of four parameters:

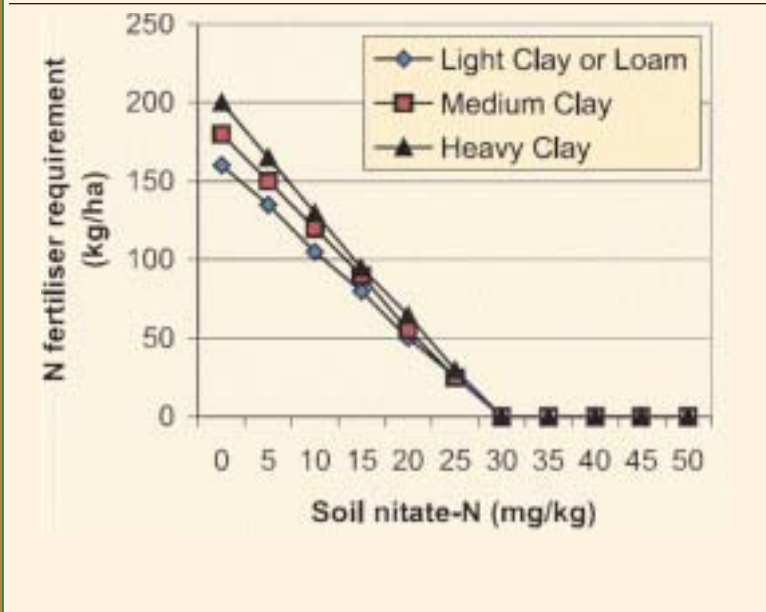
- Petiole nitrate-N (ppm=mg/kg — nitrate analyses performed by a specialist laboratory);
- Soil condition (indicative of soil texture, compaction, drainage);
- Day degrees (can be estimated by NutriLOGIC but better accessed from the Australian Cotton CRC web site for your district (www.cotton.crc.org.au/tools); and,
- Regional N response data (district recognised from the CottonLOGIC farm set-up),

The ideal time of the season to start petiole sampling is at squaring — usually early to mid December. It is important not to sample in a crop that is experiencing water stress (waterlogged or droughted) or has experienced prolonged cloudy periods in the previous few days.

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NutriLOGIC will indicate whether the crop appears to have sufficient N or requires additional N fertiliser. The

FIGURE 2: N fertiliser requirement of cotton as suggested by NutriLOGIC



program will use a single test, although greater accuracy will be achieved if three tests are conducted at weekly (or 10 day) intervals. NutriLOGIC will then calculate the rate of change in nitrate-N concentration and suggest a rate of N application where needed.

Other nutrients

At this stage, NutriLOGIC will only provide an interpretation for nitrate analyses. It does however, contain tables showing deficiency information for all other nutrients through the information button.

Further development

The development of NutriLOGIC is continuing with further evaluation throughout several cotton-growing regions. Experiments are conducted to compare the economic optimum N rate suggested by NutriLOGIC with higher and lower rates of N fertiliser.

In most instances, the N rate indicated by NutriLOGIC was close to the economic optimum N rate identified from the field experiments. In time, nutrients other than N will be included in NutriLOGIC.

NutriLOGIC, and all of the other industry 'paks' can be accessed on a CD available free to all growers and advisors. To access NutriLOGIC, contact the Australian Cotton Technology Resource Centre 02 6799 1534 to register for your copy of CottonLOGIC (free of charge to the Australian cotton industry).