A BASIC FERTILISATION STRATEGY TO ENSURE SUSTAINABILITY

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In addition to the negative publicity that the agricultural sector faces regarding the detrimental impact of unnecessary fertilisation on the environment, the cost of fertilisers is forcing producers to pursue ways to reduce fertilisation inputs. A proper balance between unreasonably conservative fertilisation and unwarranted application of nutrients is therefore required, where the emphasis should be to maintain tree health and sustain an orchard's ability to produce sufficient yields of good quality. A producer who wants to manage his fertilisation inputs accordingly needs to comprehend certain principles and take them to heart.

SOIL AND LEAF ANALYSIS IS CHEAPER THAN UNNECESSARY FERTILISATION.

The first habit to develop is a routine of taking proper, representative soil and leaf samples. Soil samples do not have to be taken annually, but a wise decision regarding fertilisation requirements cannot be made without proper knowledge of the orchard's soil chemistry and nutrient content. The foliar analysis provides you with insight regarding the extent to which nutrients in the soil are taken up – it might point you to a need to address root health and functioning. Leaf analysis also provides insight regarding the need to apply nutrients like P, Ca, and Mg that one wants to avoid due to their added cost.

THE TREES CAN PERFORM WELL WITH LESS FERTILISATION THAN YOU RECKON.

Be conservative in your fertilisation approach – the trees do not perform better when supplied with more than the required nutritional rates. Although prolonged undersupply of necessary nutrients will lead to diminishing tree performance, it is not affected overnight. Furthermore, trees with healthy roots can utilise the pool of available P, K, Ca, and Mg effectively and for a long time – making fertilisation redundant or reducing its need. It is also worthwhile calculating the extent of the available pool of these nutrients before they are included in a fertiliser programme.

OVER-IRRIGATION IS A WASTE OF FERTILISERS.

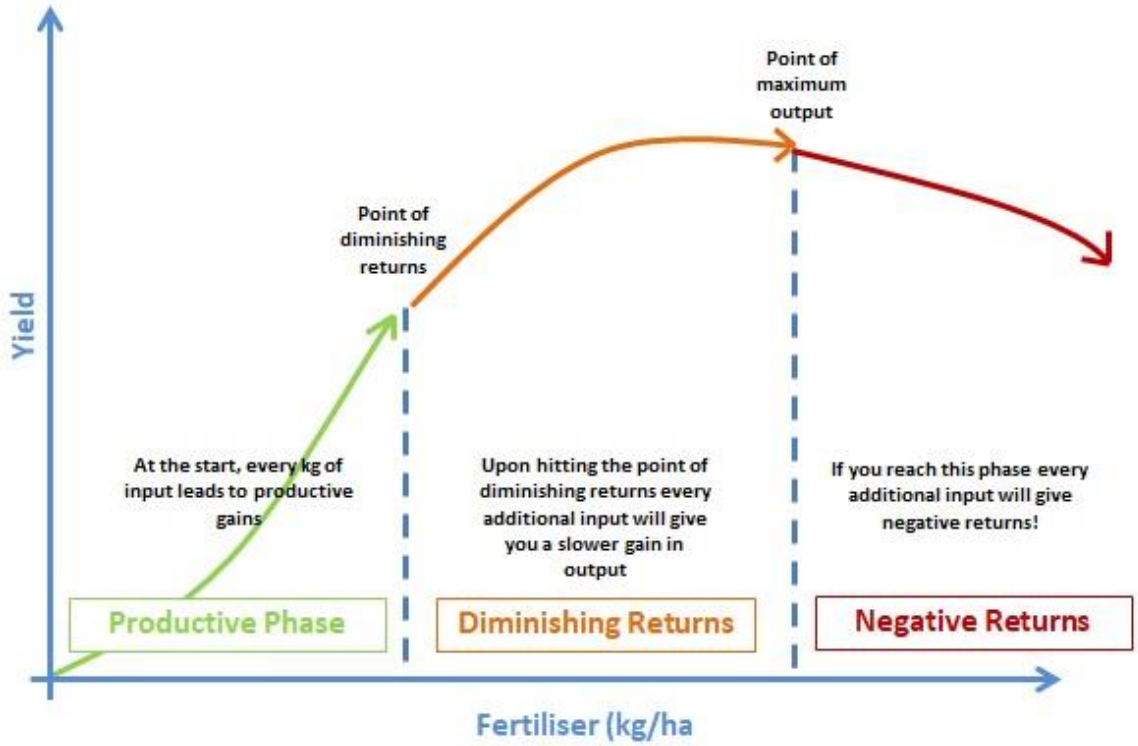
The sustained performance of many orchards during dry seasons, when less irrigation is applied, can be ascribed to improved tree nutrition. The healthier roots and less leaching from the root zone improve nutrient uptake. Avoid over-irrigation at all costs.

TREES WITH LARGE ROOT SYSTEMS REQUIRE LESS FERTILISATION.

The larger the volume of soil occupied by the roots, the longer it takes to deplete the nutrients to a deficient level. It has been shown that by applying as low as 40% of crop removal of P and K one is able to keep the soil P and K near optimal levels, while not reducing crop yield and quality in the short term. Active, protected roots close to the soil surface can potentially utilise much N from organic material being mineralised. However, roots affected by nematodes or phytophthora (mostly due to over-irrigation) will not function optimally, and the efficiency of nutrient uptake will be reduced – producers need to make sure their roots are healthy and take steps to rectify any issues in this regard.

THE LAW OF DIMINISHING RETURNS.

Tree performance will improve linearly as nutrients are supplied from extremely deficient levels. However, as the optimal nutritional status of the tree is progressively being reached, the additional benefit of increased fertiliser reduces (see the figure below). Eventually, any further inputs have no advantage and can even be harmful to the trees or crop.



With these principles in mind, the following practical, common sense, guidelines might be useful to consider. The authors are of the opinion that if producers implement these guidelines, they can save up to 30% on their fertilisation costs without having any impact on tree performance – given that they do not over-irrigate, which is a most unproductive, wasteful practice.

Firstly, in micro-irrigated orchards, no P must be applied if the concentration in the soil is above the minimum norm. The same applies to K on soil with a clay content > 10%. Furthermore, take more detailed soil samples to represent different performing sections. If the soil P concentrations in these different areas vary, apply differentiated amounts of granulated fertiliser according to the requirement – use a variable spreader for this. The same applies to K on heavy soil, while areas with sandy soils are marked for maintenance fertilisation.

Drip-irrigated blocks require special attention – sampling of soil for analysis needs to be done meticulously and more regularly. Avoid depletion of all nutrients in the wetted zone and accept that nutrient requirements will have to be met in the limited volume of roots. Optimal nutrient uptake should be sought by applying each nutrient intermittently, and then at the specific concentration that each is most effectively taken up. Where soil pHKCl is below 6.0, the fertiliser mixture should also be buffered to a pH between 6 and 7.

In sandy soil over-irrigation, and consequently, leaching of nutrients, must be avoided through exactly managing irrigation cycle lengths – the leaching loss of N and K can be especially high in drip-irrigated blocks. Ensure you know the depth of the root zone and make a point to monitor the depth of water movement after an irrigation cycle – either by making a profile hole, installing wetting front detectors just below the root zone, or using a probe. Although the cost of organically enriched fertilisers might not always justify the benefits, or actually reduce losses, the theory behind it that justifies experimentation.

Responsible soil management can assist tree nutrition and reduce the overall fertiliser requirement, or improve fertiliser use efficiency. For example, in a biologically active soil (i.e., that has a fair amount of organic material) more nitrogen becomes plant-available through the

predation and excretion of plant-available nitrogen by soil organisms. Through biological nitrogen fixation, done primarily by bacteria in association with legume plants, additional amounts of N can be obtained. The practice of establishing or maintaining legumes as an inter-row cover crop should be considered.

The history of each orchard must also be considered – especially foliar nutrient concentrations. If an orchard traditionally has high concentrations of a specific nutrient, the applied amounts of that nutrient should be reduced accordingly. It is also very important to note that, when interpreting foliar analysis, any level above the minimum norm should be regarded as optimal. The amount of fertiliser required to obtain a shift from a low level to a higher level within the traditionally acceptable ranges can be excessive, and without any benefit (remember the law of diminishing returns). In cases where leaf analysis indicates deficient nutrient levels, scrupulous application of foliar nutrition might be a more cost-effective short-term method to address deficiencies than soil application – this applies specifically to micro-nutrients, and even more so, where high soil pH reduces micro-nutrient availability. Furthermore, “scrupulous” foliar application implies that producers ensure application protocol that will be most effective, i.e., the correct concentration, suitable application volume, spray mixture that is properly buffered, application when trees have young leaves, etc.

Choice of fertilisers is also a consideration. It would generally be recommended to avoid using mixtures since the cost per kg nutrient is often higher, and if you do not need a specific nutrient, it is not wise to apply it – even more so if it carries a cost. The use of organic materials, e.g., manure or compost, and enriched organic fertilisers, should be considered carefully. If the cost justifies it, then it can be used. But if the composition does not correspond to what is required to maintain a balanced, optimal soil nutrient content, then it must not be used for more than a season or two.

Lastly, prioritisation of orchards is required in times when the exorbitant fertiliser process threatens financial viability. Avoid under-fertilising all orchards – the potentially detrimental effect of deficient nutrition should be limited to unprofitable, poor-yielding blocks. Nurture the healthy, good performing, productive orchards.