The Potash Development Association

POTASH News

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Fertiliser base dressings and timing.

Nitrogen fertilisation for good yields can be effectively managed at SNS Index 0, because nitrogen fertiliser is applied each year to make good the supply from the soil and to meet the needs of the crop. But we cannot do this with potash (nor with phosphate) on P or K Index 0 soils because it is not feasible to apply sufficient phosphate or potash to the seedbed before drilling to meet the demand for either nutrient. For phosphate careful placement may be able to supply a large proportion of the need, but for potash the quantity required by most crops is far too large and if applied to a cereal or rape seedbed shortly before sowing the effect on germination could be severe. A high-yielding crop of winter cereals or oilseed rape is likely to contain between 300 to 400 kg/ha potash in its stems and leaves, all of which has to be available from the soil. Even if there were no adverse effects on germination from such a large seedbed application of potash the crop would still not perform as well as if the soil was at K Index 2.

In principle the topsoil nutrient reserves should be maintained at a level where sufficient phosphate and potash can be found by the growing crop for its total needs; this level is maintained by replacing the amount of potash and phosphate removed in a harvested crop. This level is usually in Index 2, unless the crop has a short growing season such as some vegetable crops. For these crops the root system they can develop in the time available will be limited, even though they may be extending their total root length by up to 200 metres per square metre per day. These crops will require a higher concentration of nutrients in the soil and it is thus common practice to maintain horticultural soils at Index 3 or even higher.

So for cereals, oilseeds and other crops with extensive root systems growing in an Index 2 soil, the standard recommendation for phosphate and potash will be the quantity of the nutrient the crop is expected to remove at harvest. This dressing is ideally applied to the seedbed and well-worked in before drilling. Although application onto the growing crop during the winter is also satisfactory, planned winter dressings unfortunately do not always take place, due to weather conditions for example, and making good the shortfall in the amount of potash and phosphate in the rotation is then an issue which is sometimes overlooked.

In situations where the soil nutrient Index has been allowed to fall, it is very unlikely that phosphate or potash applied to the seedbed will be able fully to compensate for a low soil status. The more a soil nutrient status declines from Index 2, the greater the likelihood that the crop will be unable to meet all its needs for that nutrient to optimise yield, even with seedbed applications.

It seems to be fashionable to believe that there is no downside, or that there may even be a financial benefit, from maintaining a soil at a lower nutrient Index than has been found to be appropriate in the past, despite the higher yields now being achieved. The setting of mid-Index 2 as a recommended level was based on an assessment of risk – the risk of not achieving optimum yields when weather and soil conditions are less than favourable. At Index 2 a reasonable level of insurance is built in and this cover is ongoing provided that the amount of potash and phosphate removed in the harvested crop is replaced, so maintaining sufficient reserves to provide the insurance every year. The concept of maintaining soils at only Index 1 is analogous to walking closer to a cliff edge than recommended. It can be fine under ideal conditions, until there is a sudden gust of wind or a slippery patch in the grass.

Maintaining a field at an average of Index 2 makes allowance for the usual within-field variability in nutrient reserves. Areas of a field which are lower than a field-average of Index 2 will probably be mostly in Index 1, and in years with good soil and weather conditions the decrease in yield may be small. On the other hand if the field-average is Index 1, then areas with a lower reserve will probably be mostly at Index 0 and on such areas it is most unlikely that a crop will perform satisfactorily. Furthermore, the areas of low nutrient reserve in fields are often associated with the parts of the field with the highest yield potential, where nutrient removals at harvest have been higher than the average. There is thus a potentially greater risk to the best parts of a field by maintaining an average soil nutrient status at Index 1.

Where soils are at a low Index there are a number of management actions which can be taken to reduce the risk of loss of yield or quality until the soil reserves can be replenished. The application of fertilisers to the seedbed is the most obvious, although the quantities of nutrients which can be applied in this way can be limited due to potential adverse effects on germination. This is less of a problem with freely tillering and branching crops such as cereals and oilseed rape, but can be a major constraint where crops such as sugar beet are drilled to a stand.

An improvement to the incorporation of nutrients into the seedbed, especially for cereals, can be the use of a combine drill. However this can have an effect on germination, and may also slow down the drilling operation. Combine drilling is a useful technique where the soil nutrient levels, especially phosphate, are low, but it is unlikely to give consistently the same result as would be achieved if the soil were not deficient.

Phosphate is particularly immobile in soils, moving at most only a matter of millimetres, and a poor-rooting crop may not be able to find enough even in Index 2 soils, so for these crops, such as potatoes, some assistance may be beneficial. Fertiliser placement techniques may be used, whereby a significant proportion of the nitrogen, phosphate and potash dressing is placed below and to the side of the seed potato tuber. The positioning is such that as the roots grow from the mother tuber they will inevitably encounter the fertiliser band. When roots take up nitrogen or phosphate there is a signalling within the plant which encourages more roots to grow in that area, thereby maximising the efficiency of recovery.

New products are now on the market which are designed to reduce the short term immobilisation of phosphate. The concept is potentially useful where soils are phosphate deficient, or likely to be so.

Soil structure and cultivation method can affect the efficiency with which crops are able to utilise soil phosphate and potash (and other nutrients). High-yielding areas within fields are usually associated with deep, well-structured soil, where crop root systems are unconstrained. The ability to rapidly develop an optimal root system that maximises the volume of soil explored by the roots (even though this may still be only 25% of the total nutrient-enriched topsoil) enables the crop to 'find' more phosphate and potash than it could with a restricted root system. Under these ideal circumstances (uncompacted, deep well-structured soils with an adequate supply of water) the crop may be able to access all it needs even from an Index 1 soil.

Another point for consideration is that with the adoption of minimal cultivation systems applications of phosphate and potash tend to stay in the top 3-4 inches of the topsoil, whereas with ploughing they would be distributed relatively evenly throughout the topsoil. This presents two potential difficulties: firstly it complicates the taking of soil samples because these are assumed, for the purposes of the recommendations, to reflect the concentrations in the whole topsoil profile (see PDA Leaflet 24, 'Soil Analysis'). Soil samples taken in the traditional way on these soils may suggest a higher Index status than would be the case if the land had been ploughed. Secondly while this 'stratification' of nutrient concentration may be beneficial in the early stages of growth, in a dry season it could result in lower nutrient concentrations and root growth in deeper moist zones.

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