FERTILIZER PLACEMENT NEAR CROPS

2011 author: A. Delgado

Description
Nutrient placement near crops is known to increase the efficiency of nutrient use by plants. Also, the fraction of agricultural surface enriched with nutrients is decreased, which can contribute to a decreased N and P losses from agricultural soils through runoff. Fertigation using drip irrigation systems can provide a highly efficient method for nutrient placement near crops.

Rationale, mechanism of action
Nutrient placement near plants has proved to increase the uptake efficiency. It is well known that this practice can be particularly useful on low P soils for increasing the efficiency of the use of this nutrient [1]. Fertigation via a drip irrigation system can provide a single and effective method for placing nutrients near crops. Beside this, the increased water use efficiency, the maintenance of a near-constant water content, and the decreased drainage when high-frequency drip irrigation is used contribute to a higher efficiency in N and P use by crops [2,3]. Similar yields have been found with decreased N rates applied with drip irrigation when compared with flood irrigation [4]. A decreased drainage fraction also contributes to a decreased risk of losses through drainage, particularly on soils with a low water holding capacity [2]. Also, fertigation avoids that nutrients applied remain on the soil surface accounting for a decreased risk of losses through runoff, especially via incidental losses.

Applicability
Placement of fertilizers near crops in bands on rain fed land requires the use of special machinery for fertilizing and sowing. In particular on irrigated land, fertigation via drip irrigation could be of interest. Besides the investment in drip irrigation, no other installations are necessary beside those for other irrigation systems (pump power, e.g.)

Effectiveness, including certainty
The measure could be effective for increasing water use efficiency and decreasing nutrient losses via runoff and drainage. In the case of P, very frequent applications can increase the ratio of labile to non-labile P forms, e.g., through decreasing the P precipitation rate which is higher when large amounts of fertilizer are applied. However, the potential risk related to this effect on the geochemistry of P in soil could be compensated by decreased fertilizer rates and by the enrichment in P of only a fraction of the soil surface.

Time frame
In general terms, the effect of decreasing N and P losses and the effect of disappearing incidental losses can be expected on short term. However, in N enriched soils there could still be significant NO_3 losses after the installation of the method [2].

Environmental side-effects / pollution swapping
Additional effects on loss of pesticides are expected if they are applied with irrigation water (e.g. for nematodes). Also, water saving in dry regions is an additional and relevant potential benefit of this measure [4].

Relevance, potential for targeting, administrative handling, control
The option can be relevant for all irrigated fields, in particular for intensive crops which require high N and P rates.

Costs: investment, labor
On irrigated fields, the estimated additional costs per hectare could be around 2500 - 3000 € when compared with furrow irrigation, and range between 0 and 1000 € when compared with high efficient sprinkler irrigation (depending on wether PVC or polyethylene is used). Subsidies for covering costs of investment could be of interest because potential benefits include not only the reduction of non-point pollution (N, P, pesticides), but also because of soil conservation and water saving, which are important topics in arid and semi-arid regions.

References
[1] Matar A., J. Torrent, and J. Ryan J. 1992. Soil and fertilizer phosphorus and crop responses in the dryland Mediterranean zone. Adv. Soil Sci. 18: 81-146.
[2] Vázquez, N., A. Pardo, M.L. Suso, and M. Quemada. 2006. Drainage and nitrate leaching under processing tomato growth with drip irrigation and plastic mulching. Agric. Ecosys Environ. 112: 313-323.
[3] Ben-Gal, A., and L.M. Dudley. 2003. Phosphorus availability under continuous point source irrigation. Soil Sci. Soc. Am. J. 67: 1449-1456.
[4] Thind, H.S., M.S. Aujla, and G.S. Buttar. 2008. Response of cotton to various levels of nitrogen and water applied to normal and paired sown cotton under drip irrigation in relation to check-basin. Agric. Water Manage. 95: 25-34.