4. DISCUSSION

It is likely that less than one half of the nitrogen fertilizer applied for crop and pasture production is recovered in crop products in the year of application. The remainder is lost to the atmosphere, organically fixed in crop residues or lost in run-off or to drainage below the usual level of root growth. The proportions vary considerably from area to area, crop to crop and year to year. Any residual nitrogen which is not transferred from the crop production site in marketed produce has a potential to enter the water cycle, via run-off of soluble fertilizer products such as urea, or as dissolved ammonium and nitrate, in sediment and organic matter to streams and rivers, and by percolation to underground water resources, which may enter streams subsequently.

Of the 80-85 000 tonnes of nitrogen being applied annually in fertilizer, 20-30 000 tonnes are contained in products sold off-farm. While there is some evidence of organic nitrogen accretion in soils under green cane, trash blanket systems and under some pastures, most of the 50-65 000 tonnes not utilised by crop growth is eventually lost to the atmosphere, and to run-off and leaching from the site of application.

Annual nitrogen losses to streams are likely to be quite variable, depending mainly on rainfall amount and intensity, on density of ground cover and on fertilizer application methods and timing. Losses are likely to be more considerable in the high rainfall areas where run-off, as a proportion of rainfall, is high.

The greatest transfer of nitrogen is likely to be from the basins with the highest ratios of nitrogen use: run-off volume, listed in table 11.

Recovery of applied phosphorus by crop and pasture plants is considerably lower than for nitrogen, in the year of application. Any phosphorus not utilised is fixed in the soil in organic and inorganic forms, some of which become available for uptake in following years. Major system losses depend on soil loss by erosion, as soluble phosphates tend not to stay long in the soil solution, unless the soil has a low clay percentage and low organic matter status.

Of the 13 000 tonnes of phosphorus being applied annually in fertilizer, 1-2000 tonnes are contained in products sold off-farm. Most of the remainder, together with similar proportions of phosphorus applied previously, accumulates in the soil in forms which are of low availability to plants - hence the need for re-application for each crop or crop cycle.

As with nitrogen, there is a high potential in some areas for loss of phosphorus from agricultural systems to associated streams and rivers (and eventually to the marine ecosystem) and to aquifers. Such losses are likely to be higher where rainfall and run-off are highest and where residual phosphorus levels are also high. The actual losses will depend on phosphorus application methods and rates, as well as soil characteristics, for each cropping system.

The greatest contribution of phosphorus to water systems is likely to be from the basins listed towards the top of table 11, i.e. those with a high ratio of phosphorus use to run-off volume. This contribution will be mediated by the structure of the basin, in so far as potential sources of phosphorus loss may not coincide with run-off sources.

Total phosphorus applications to the eastern catchments adjacent to the Great Barrier Reef since 1920 probably exceed 400 000 tonnes (as against about two million tonnes of nitrogen). It is likely that a high proportion of this phosphorus is still contained in the topsoils of the 600 000 hectares of land to which it has been applied over the last 70 years.

As such, the phosphorus represents both a valuable resource and a major source of potential loss into aquatic systems. On both counts, it necessitates the use of farming practices which ensure losses are minimised, so as to protect the long-term nutritional fertility status of the land and to reduce any potential adverse impacts on Great Barrier Reef ecosystems.