Aspects of Applied Biology 79, 2006
What will organic farming deliver? COR 2006

The changing needs with time for mineral nutrition of organic stone fruit orchard under Mediterranean conditions

By MICHAEL RAVIV*, IDO AVIANI & YAEL LAOR

Agricultural Research Organization, Newe Ya'ar Research Center, P.O.B. 1021 Ramat Yishay, 30095, Israel
**Corresponding author E-mail:* mraviv@volcani.agri.gov.il

Abstract

Mediterranean climatic conditions for stone fruit production are good but soil fertility is low, mainly due to low (< 2.0%) soil organic matter (OM). Consequently, conventional growers apply high fertiliser rates (typically ~350 Kg N ha^{-1} yr^{-1}). Our main objectives were to compare the effects of 2 modes of nitrogen nutrition, suitable for organically-certified orchard *vs* a conventional control on tree development, yield, and some soil chemical, physical and biological properties.
The orchard is located on a Grumosol soil, in the Jezreel Valley, Israel and is treated organically in terms of plant protection and weed control. The orchard was planted to peach, plums and nectarines in 1998, all grafted onto rootstock CV. 677. The tested treatments were: A. conventional control, receiving an average of 350 Kg N ha^{-1} yr^{-1}; B. fertilization using cattle manure compost (40 m^3 ha^{-1} yr^{-1}) + feather meal (1 tonne ha^{-1} yr^{-1}); and C. a combination of the same amount of compost + 500 Kg feather meal ha^{-1} yr^{-1} + leguminous cover crop (Alfalfa, *Medicago sativa* cv. Gilboa). The cover crop was mowed 7–8 times per year. There were five replicates per treatment, of nine trees per replicate and the experiment was arranged in a randomised block design. The experiment lasted 6 years.

OM content of the native soil (5–30 cm) was 1.8–2.0%. By 2003 the OM content of the conventional control treatment remained stable; that of treatment B increased by 36% while that of treatment C increased by 91%. This change was reflected in a clear and statistically significant change in soil's bulk density values which were 0.80, 0.73 and 0.71 gr cm^3 for treatments A, B and C, respectively. At the beginning of the experiment levels of soil nitrate, phosphate and potassium ions were somewhat lower in treatments B and C than those in A but they became consistently higher after 2–3 years. The levels of these ions in the 30–60 cm soil layer followed the same trend at a 1–2 years lag. Nitrification capacity of the soils of treatments B and C were twice as high as those of treatment A. Consequently, beginning 2002 application rates of organic amendments were reduced. Yet, no decline in nutrients levels in the organic treatments could be detected over the period 2002–2004, presumably due to continued mineralisation of the OM pool. In 2004 various soil microbial characteristics (microbial counts, fluorescein diacetate hydrolytic activity, functional richness and diversity) were determined. In all these parameters the organic treatments showed higher levels than treatment A.

From the autumn of 2002 on, stem circumference are similar for all treatments and for all species. No statistical differences could be found among the treatments in any of the tested species for the 3 year cumulative yields.

It can be concluded that once a significant buildup of organic matter in the soil is occurring, organic matter application can be reduced considerably, as a significant soil's potential productivity has been built.