The need to recycle societal P in organic farming systems

Hand-out for Improve P workshops – Author: Dr. Julia Cooper

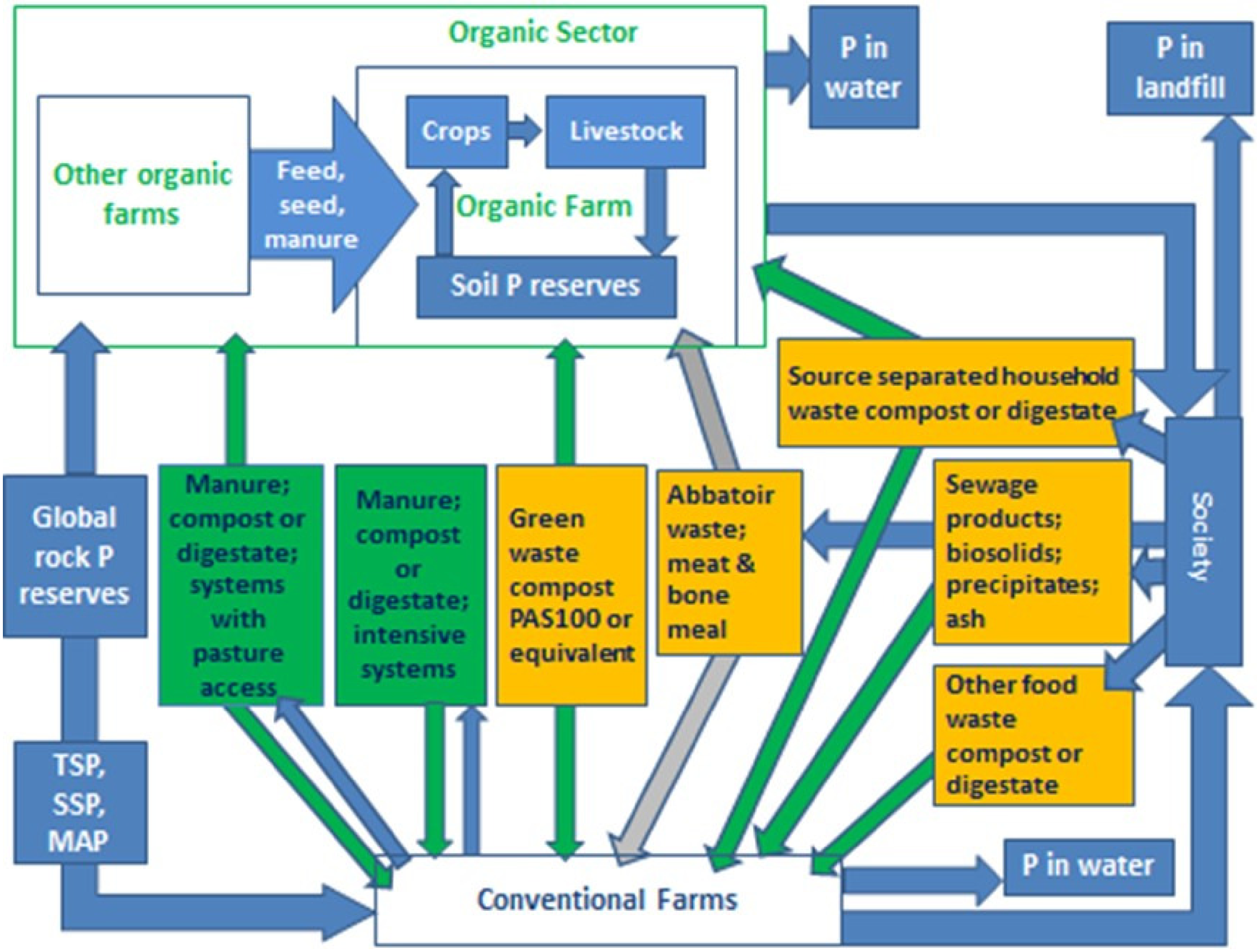

Figure 1. Illustration of the flows of P between natural reserves, agricultural systems and society

The need for efficient use of P in organic farming and the importance of recycling P from society back to agricultural systems has been highlighted, most recently by the Soil Association's publication: A rock and a hard place (Soil Association 2010). The IMPROVE-P project (https://improve-p.uni-hohenheim.de/) addresses the challenge of supplying P in organic farming systems in the face of dwindling supplies of rock P and conflicting opinions on the risks associated with societal sources of P, balanced against the fundamental organic principle of recycling P. Currently, organic farming systems are often dependent on P that has been mined from global reserves of rock, either through direct inputs of rock P, or indirectly through the recycling of P from different sources (Figure 1). The use of non-renewable P can be minimised and the sustainability of organic farming improved by:

1. **Eliminating losses of P to water** Eliminate all erosion of soil from fields. Prevent runoff of nutrients from manure and compost storage areas, and avoid runoff by manure application.

2. **Maximising efficiency of P use on the farm** Use diverse crop rotations, alternate deep and shallow rooted crops, promote beneficial soil organisms (e.g. mycorrhizal fungi), recycle all farm wastes back to the land, spread animal manure to coincide with crop demand.

3. **Judicious use of allowable P fertilisers** Even if losses are minimised and efficiency of P use on the farm is maximised, the P that is removed in the crops through export may need to be replaced by importation of P, particularly if soil P is declining and approaching deficient levels. While some farms are able to achieve a balanced supply of P through importation of animal feed, other farms, particularly stockless arable and horticultural systems, need to use allowable P fertilisers such as conventional manure to replace the P lost through export of products

Using societal wastes to "close the P loop"

Can organic farming systems really be sustainable, if we don't "close the P loop" by recycling more societal waste back to organic farms? Many of the societal wastes that could be recycled back to organic farms are shown in Figure 1 (amber boxes). With growing consumption of organic products, and more advanced cleaning technologies, sewage products are of particular interest. Figure 2 shows the various stages of the sewage treatment process where P can be recovered.

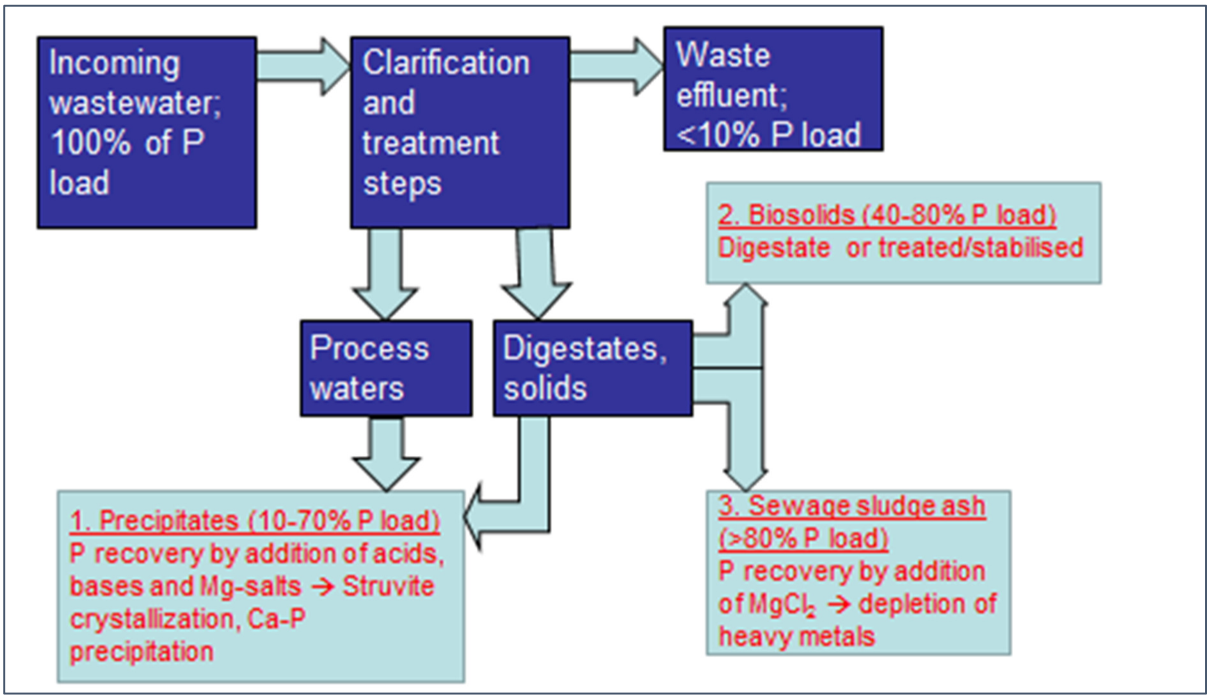

Figure 2. Hotspots for P recovery in urban wastewater treatment plants

Precipitates can be recovered from wastewater, and from the anaerobic digestate (Figure 2). P in precipitates has high plant availability, but low water solubility.

Biosolids are treated sludges such as dewatered digestates that may contain up to 80% of the original P, and also provide other nutrients and organic matter for the soil (Figure 2)

Ashes are produced when solids are incinerated (Figure 2)

How do we decide which wastes are acceptable in organic systems? We need to consider:

Pollutant content Pollutants to consider are: heavy metals, persistent organic pollutants, antibiotics, hormones, other pharmaceuticals, pests and pathogens.

Environmental impacts during production How much energy is used to produce the product? What kinds of pollution occur during the process? Are non-renewable resources, toxic compounds etc. used in the production?

Ethical issues Is the material a by-product of a system that results in reduced human or animal welfare, or does not support sustainable development? An example of this is the prohibition of livestock manure from intensive livestock units, or the continuation of water-based toilet systems in regions with increasing water scarcity.

GM contamination This is both an environmental and ethical concern, as well as one involving consumer trust.

Permitted and prohibited--- not justified by contents of heavy metals

An evaluation of P fertilises applicable for OA should also include a comparison with currently permitted P fertilisers.

An example is shown in Figure 3 which illustrates the heavy metal nutrient (HMN) index for various permitted and prohibited P fertilisers, in a system where the "toxicity" of each element is taken into account, as well as the P concentration of the compound in question. Interestingly, a permitted P source such as GAFSA rock-P has a much higher HMN than many currently prohibited sources such as sewage sludge.

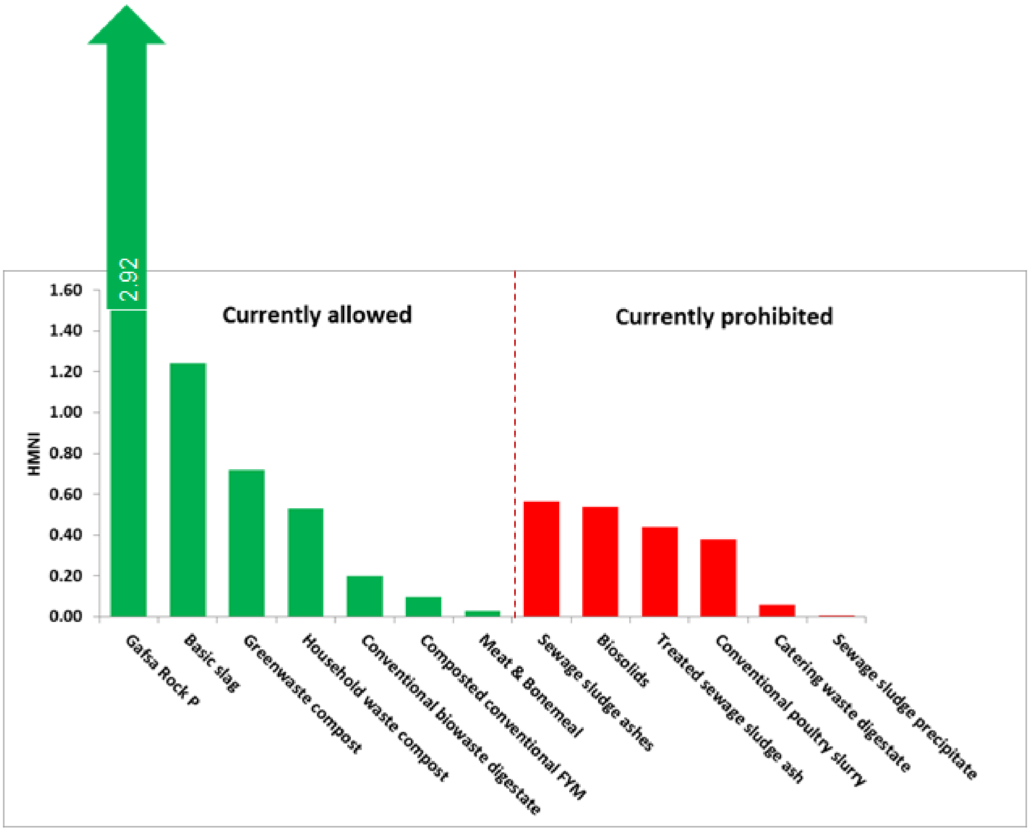

Figure 2. Heavy metal nutrient index for a variety of allowed and prohibited sources of P

Source: Herter & Külling 2001; further developed by Möller & Schultheiss, 2014 (KTBL-Schrift 499, Darmstadt, DE)

Please fill in our questionnaire to let us know what you think about these issues

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