SOFI'S LEAF COLLECTION AND PROCESSING

This description of collecting leaves and producing leafmould was prepared for a PhD student researching a dissertation on the subject under the auspices of the HDRA

[The Potential for Leaf Recycling in the U.K.: Rebecca Baldock: August 1997: Coventry University]

We've been making leafmould for ten years for practical and opportunistic reasons; it was a free resource, abundantly available and underexploited. We have evolved methods of urban scavenging to facilitate as much local, organic food growing as possible. By accessing free resources such as leafmould, compost and other recycled resources, we can stretch our expenditure further, allowing the purchase of high grade imported organic fertilisers such as seaweed meal. Leafmould is the most valuable and versatile free resource available to us as food gardeners.

For the past five years, our leaf harvest has followed roughly the same pattern. We borrow a van [Transit/Urvan-size] and collect for 5-7 days from late October to early December [i.e. November]. We hope that dry, warm days, when the wind has recently piled up newly fallen leaves, coincides with when we have transport. We have perfected a method adapted to our scale of operations using large wooden hay rakes [18 inch] and inch-mesh nets for dry leaves [3 x 4 m recycled volleyball net] or 1000 L builders' merchants' bags for wet leaves. We drive out to the genteel old leafy suburbs on the west side of Sheffield, where mature Victorian trees planted along wide, quiet avenues which yield large crops of oak, beech, lime, chestnut, ash, maple and a wide variety of more exotic garden species. We try to choose roads with minimal traffic, grass verges and target the best possible quality and quantity available. Netloads are lifted into the van and packed down if dry.

Large volumes of leaves have some characteristics of a fluid when fresh and dry. They can be swept along and will flow over each other when pushed along. A metal rake scrapes too deep, scratching up tarmac and stones with the leaves and getting caught on minor obstacles like tree roots and cracks in the pavement.

In terms of the actual number of leaves collected, a dry load of 500 Kg is equal in volume to a 1 tonne wet load [unsaturated], and would require 3-4 times the volume of storage space when loosely stacked. It depends on just how wet the leaves are, but the energy and effort required to lift and shift them is much greater; twice as hard due to the weight of the adhering water. Warm, wet, muggy days are the most unpleasant conditions for collecting since you get wet on the inside as well as outside. We deliver about six vanloads per day and deliver these to a variety of allotment sites. They are stacked loosely in large bays [2-4 m square]. If the leaves are dry, they can be stacked up to 1.5m [6 ft] high, but the higher they are stacked the more they will need to be turned subsequently to ensure they are moist throughout.

The optimum condition of leaves for processing is approximately 25-50% water to weight of leaves, achieved when dry-fallen leaves have been exposed to showery rain for 48 hours or continuous rain for 24 hours. This can be achieved by progressively watering the heap when it is turned if no rainfall is available. In this state, a heap of sufficient critical mass [3-4 cubic metres] will heat up to 40-50 ^{o}C within a week irrespective of outside temperatures. However, without turning to redistribute moisture, the center of the heap will overheat and burn-out in the leaf equivalent of firefang, a white mycelium which reduces the leaves to a fungal mush when wetted. This is partly caused by the natural dynamic of the flat leaves settling into laminated layers, which act as increasingly efficient insulation for the center. If the heap can be inverted, turned inside-out and the moisture evenly redistributed, this exothermic bacterial-fungal reaction can be maintained for 2-4 weeks, if tended regularly, depending on weather [intensity and duration of frosts]. When able to harness this heating process, it is possible to create material which is friable [choppable within two months and can be dug into the soil in the first spring after collection.

Like compost heaps, leafheaps will benefit from additives if they are evenly distributed. Powdered limestone, specifically containing magnesium [dolomite or calcified seaweed], feed and favour flushes of bacterial growth which in turn invigorate the actinomycetes [slime-moulds] which together start to break-down the cellulose structure of the leaves. Lime should be added as a very fine powder to guarantee maximum distribution throughout the heap, but could also be sprayed on in water-suspension. If the heating reaction is strong and permeating the whole heap, diluted compost activator [piss] will further strengthen and prolong the heating. However, if the leaves are already saturated or too cool, no benefit is gained. The much longer maturation phase of the heap also provides opportunities to improve the quality of the finished mould. The basic aim should be to use minimal inputs to produce a homogenised base material for a full spectrum of uses. Hence any soluble agents for raising fertility should be added to the mature mould when it is included in mixes for specific uses. Insoluble mineral agents such as volcanic rock dust can be added at the preliminary stage to make use of the long storage time to break rockdusts down, resulting in a completed leafmould with additional plant nutrients and trace elements. Both lime and rockdust should be added at a rate of 2-5 Kg per metric tonne.

We also collect beech and maple leaves from a nearby disused allotment site, which has reverted into young woodland. In this case it seems fitting to extract a small proportion of the annual leaf-fall to replenish working allotment soils nearby. Depending on whose land they're on and the status of the trees, extraction from woodland could be inadvisable. Excessive extraction could be ecologically disturbing and change the nature of an area of woodland, depriving plants and fungi of their annual mulch. But it could equally help to create more diverse habitats for plants demanding low fertility. It is also possible to create patches of deep litter mulch [*eco-piles*] made up of twigs, branches and rocks removed from the forest floor preferably before leaf-fall, providing useful new opportunities for animal shelter and enhancing the soil-formation process in these areas. As a rule, no more than 50% of the total shed of leaves should be removed in any given year.

Clearing leaves from public land is justified by the precedent set by the ancient Rights of Common, such as grazing and turbury [turf-cutting]. *Leabury*, the right to extract part of the leaf-harvest form common land, accompanied other privileges such as fattening pigs by allowing them to eat beech mast. Although catastrophically reduced by centuries of enclosure and privatisation of forest, these rights were never rescinded and are therefore presumably still applicable.

In total I would estimate that we make **10** tonnes of finished material annually. The majority of this is distributed over two acres of fruit and vegetable beds and 25-50% is retained as a base for a variety of potting mixtures. This supplies a large requirement for raising young vegetable seedlings and also provides enough medium for raising 1-2000 cuttings and herb plants in small pots annually. These intensive nursery applications are the most effective use for fully mature leafmould. We have never experienced 'damping off' or retarded growth in beech mould, both of which are sometimes mentioned as worries in connection with leafmould.

In our experience, leafmould is both superior to and more versatile than either peat or coir.

The end-product contains a wide spectrum of trace elements, according to the diversity of tree species included. The decomposed leafmould has a very high humus-forming potential when digested by soil micro- and macro-organisms, with consequent benefits for soil structure and the mobility of nutrients throughout. Humus is formed when the minerals in the clay are bonded onto the proteins from the leaves. On heavy clay soils there is no better agent for radically improving structure, tilth and water-holding capacity.

SPECIAL METHODS OF PROCESSING LEAVES

1. INSTANT Fresh leaves can be dug straight into very rough, weedy or heavy ground to help mechanically break up clods of clay and start to increase humus and soil micro-life. This is appropriate in the early stages of reclaiming overgrown land for cultivation over an extended period followed by later weed-control and green manuring. Inclusion of fresh leaves would also be a suitable method of initial improvement preceding the planting of any perennials, since they would be well incorporated into the soil by the time the plants are well-established.

2. PASTEURISATION Compost freshly collected moist leaves by sprinkling with magnesium limestone. Turn every 3-7 days to re-distribute and extend flush of heat for as long as possible. Dampen hot, dry spots in the center of the heap. Chop through the leaves vertically every 10-15 cm with a sharpened spade when the reaction ceases [after 2 months].

3. ERICACEOUS FOR ACID-LOVING PLANTS [CALCIFUGES] Include predominantly evergreen tree leaves [at least 50% by volume], such as conifers, rhododendron, holly etc. These have tougher structure and will take longer to break down [2-3 years], which can be speeded up by repeated chopping and turning.

By collecting sufficient leaves at one time, they can actually be composted, to create genuine humus-rich leafmould in less than six months. If a sufficient critical mass of leaves [minimum **1000L** = **1 cubic metre**] can be gathered within a short period of time [**one month**], fungal spores will multiply as they consume the bacteria on the surface of the leaves, which generate a heating reaction. The heat [**40 ^{o}C +**] effectively sterilises the material and can break down the cellulose structure of the leaves if it can be maintained for several weeks. Successful 'cooking' can produce material which is friable [choppable] in the first spring after collection [**12-16 weeks**] and can be incorporated into the soil [dug under] with no ill effects.

The reaction will begin spontaneously from airborne spores on the leaves. Whereas a compost process involves innumerable different species of micro-flora [bacterias, fungi, moulds etc.], the digestion of leaves into leafmould is achieved by a small number of specialist thermophilic bacteria and actinomycetes [slime moulds]. The exothermic [heat-producing] reaction can be cultivated by ensuring there is sufficient moisture, aeration and insulation within the heap, in the same way as a regular compost heap is managed. However, because of leaves' structure and becauuse the reaction relies on just a few microspecies and has less progressive chains of redigestion of smaller by larger organisms, as is the case in compost, the hot phase of a leaf heap is less stable and more liable to interruption than a typical composting process. Unless the leaves are restacked regularly [**every 3-5 days**], to redistribute moisture throughout and restructure the heap to permit better aeration, the reaction can burn itself out due to lack of air or moisture.

The leaves need to be half-saturated [retained moisture content = **50% by weight** : twice the weight of the dry material] for the initial inoculation to be able to colonise the whole heap. This moisture content should be maintained, replacing water lost to evaporation. Large numbers of leaves in a heap have colloidal physical dynamic qualities, their flat shape means that they settle into layers which insulate the center of the heap, retaining heat within the heap. Within 5-7 days of stacking, evaporation from the hot center can cause the reaction to burn itself out in a process similar to firefang in compost. This laminating structure becomes so efficient after 7-10 days that it is impermeable to air and the reaction is suffocated and stops.

The aim of turning the heap should be to invert it [top-down + bottom-up] to distribute moisture throughout, and restructure it [inside out + outside in] to redistribute heat and aeration. Ideally, a stack should be turned regularly **twice a week for one month**. Initially, the leaves can be left uncovered until sufficient rainwater has wetted the whole mass. Hotspots at this stage can be spread to inoculate the rest of the heap with active digesting organisms. Once the reaction has been spread throughout the pile and sufficient moisture is present, the whole can be covered with plastic to retain and recycle condensed evaporation back into the heap, and with insulating materials such as carpet to allow heat to be generated and retained right out to the edges of the heap.

Well-tended heaps treated in this way are then warm enough to withstand the chilling effects of winter frosts and will remain warm for up to two months until all the bacterial nutrients on the leaves have been digested. Once the exothermic reaction has ceased, the stack can be left open to the elements, in the spring, to resume a more gradual maturation process, or chopped through which reduces particle size and increases surface area, speeding up the breakdown of the leafmould.

The heating reaction can be enhanced and harnessed in several ways to improve the process and the end-product, remembering that it is relatively fragile and can be easily disrupted. Small doses of fine dolomitic limestone powder, which contains magnesium, [**2 Kg per 1000 Kg leaves**] applied soon after collection, stimulate bacterial flushes and help to counteract the slight acidity of an average selection of leaves [especially if leathery, evergreen leaves are included]. Nitrogenous liquid feeds [such as urine or nettle tea] can be judiciously introduced to supplement water lost to evaporation when and where the heating reaction is strong. Care should be taken not to overwater and loose nutrients to runoff or leaching. Despite their cellulose structure, leaves will only have carbon available to bond onto introduced nitrogen after the exothermic reaction has begun to break down their molecular structure. Other soluble fertilisers could be introduced at this stage but only a small proportion of such materials will be bonded onto the structure of the leafmould, the rest remaining as free floating nutrients. Whilst lime is essential to the metabolism of the heating reaction, other additives are not necessary and should only be added where a higher fertility medium is required as an end-product.