

In search of a perfect cut

adins will also be available with a new vertical rake attachment.

A useful feature on the 55cm (22in) pedestrian greens mowers from Saxon Industries at Hungerford, Berkshire, must be their drum brakes. The mowers – one with, and one without groomer – have de-mountable transport wheels for moving between greens and staff can 'drive' them at up to 7mph, says the company. Belts and chains have been dispensed with in favour of gear drives and the 9 blade cylinder has a cutting height adjustment from 3mm to 13mm. The company also offers a 9hp triple reel ride-on.

Ransomes offers an extensive range of machines from pedestrian units to ride-ons and gangs. Three of its ride-on models, the GT Champion, GT Classic and Fairway 5000, are exclusively for green and fairway use. The GT Champion has a diesel engine and is available with Verti-Groom, Verticut or Tee cutting units. In standard rig with 3 Verti-Groom units it has a retail price of £16,275.

Another company with a full range of equipment is Lely (UK) Ltd from St Neots, Cambridgeshire, marketing TORO machines. The company claims a unique feature of its triplex Greensmaster 3100 is the hydraulic oil leak detector which sounds an alarm, alerting operators to move off the green. Other features include an engine mounting system, said to make it one of the quietest machines available.

Turner World Mowers of Kings Coughton, Warwickshire is a new company, but its range of machines already includes five models of triple reel ride-on mowers, each with a choice of cylinders. At the top of the range is the diesel-engined 390 which has a cutting width of 2.47m (8ft 4in).

Brouwer equipment is marketed in the UK by Turfland Professional Ltd, based in Dutton, Cheshire. The range of trailed mowers includes five and seven-gang fairway mowers offering cutting widths of up to 4.8m (16ft). Gangs are raised hydraulically, while drive to the cylinders is mechanical, operating from the pto of the tractor unit.

A wide variety of factors are important in the design of a reel type grass mower, and they may cause the resulting machine to perform well or poorly depending upon how they are combined in the final machine. Some of the important factors include: the height of cut range in which the machine will be used, what type of terrain will be encountered, clip length, reel diameter, reel construction, reel helix, bedknife/bedbar design, the cutting unit suspension system, the clippings discharge or collection requirements, and the method of adjusting the reel to bedknife contact or clearance. While all of these are important factors, only the method of adjusting the reel to bedknife contact or clearance and the resulting implications will be discussed here.

Reel and bedknife adjustment methods

There are two concepts of adjustment method. One concept is to adjust the reel down toward the bedknife (moveable

reel). The other concept is to adjust the bedknife up to the reel (moveable bedknife). There are, of course, variations in methods of doing each of these concepts, such as whether there is one adjusting knob or several adjusting bolts.

Each of the methods can be made to work well, and each has a number of potential advantages and disadvantages, depending upon the execution and the final requirements for a given machine. These will be discussed in order that the reader may have a better understanding of reel type mowing machines.

Moveable reel

This method provides a fixed bedknife/bedbar assembly which is rigidly attached to the cutting unit frame. The reel assembly is then adjusted down within the cutting unit frame. Potential advantages include:

1. a rigid cutting unit frame assembly, since the bedbar can be a torsional structural member,
2. a consistent angle of the bedknife to the turf as the reel and bedknife wear, ➤

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In search of a perfect cut

'For some applications of reel mowers, the change of height of cut during the life of one bedknife is not significant'

since the bedbar does not rotate, 3. a relatively simple adjustment of differing amounts from end to end if the wear is uneven for some reason, since each end is adjusted independently.

Potential disadvantages include:

1. a heavy and possibly cumbersome adjustment mechanism since the entire reel and reel drive assembly must be moved,
2. a locking mechanism required to hold the reel in place after adjustment,
3. changes in height of cut as the bedknife wears.

Moveable bedknife

This method provides a fixed reel assembly within the cutting unit frame and a bedknife/bedbar assembly which is held in the cutting unit frame and pivoted at the ends by some means to adjust the contact or clearance.

Potential advantages include:

1. a simpler cutting unit frame system, since the reel and reel drive system do not move in the cutting unit frame,
2. a simpler adjustment method, since the adjustment can be done with one knob and no tools if desired.

Potential disadvantages include:

1. a likely slight change in bedknife angle to the ground as the bedknife and reel wear, unless an adjustment is provided.

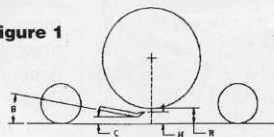
The old height of cut change debate

For years, people have debated which of the systems was better from the stand-point of change in height of cut of the machine as the reel and bedknife wear. After all, the reason for adjusting the reel or bedknife is to compensate for the wear of the cutting surfaces during use.

If these did not wear, a perfectly set up machine would stay that way forever. But they do wear, and generally the bedknife wears 5 to 10 times as quickly as the reel. Because the bedknife wears faster, the method of adjustment has the possibility of changing the height of cut as the parts wear. Consider the cutting unit cross section in figure 1. For a moveable reel concept, the bottom surface of the bedknife is fixed with respect to the ground, and distance "C" does not change as the reel is adjusted to the bedknife. This means that as the bedknife wears, the height of cut "H" is

reduced as the reel is adjusted down toward the bedknife which is wearing away. The height of cut will change by an amount equal to the wear thickness of the bedknife. For a greensmower, this height of cut change will be very significant, perhaps changing from 0.187" to 0.125" as the bedknife wears.

Figure 1



For a moveable bedknife concept, the reel distance to the ground (distance 'R' in figure 1) is fixed, and does not change as the bedknife wears and is adjusted up toward the reel. This means that as the bedknife and reel wear, the height of cut is actually raised by the amount of reel wear. However, the reel wear is about 5 to 10 times less than the bedknife wear. For the above example, the bedknife wear life is about .062", and during that time the reel would wear about .006" to .012", so for almost all circumstances the change in height of cut is insignificant during the life of one bedknife.

On a machine which has several cutting units, changing only one bedknife (not all of them) will result in a mismatch cut due to the wear of the reel and bedknife. This mismatch cut will be much worse on the moveable reel concept, due to the lip height of the bedknife having such a great effect on the height of cut. This is why manufacturers recommend changing all bedknives in a set.

For some applications of reel mowers, the change of height of cut during the life of one bedknife is not significant. However, for low heights of cut such as on the green, the change of height of cut caused by normal bedknife wear with the movable reel concept would be a significant problem. For this reason, all successful greensmowers are of the moveable bedknife design, as are virtually all cutting units designed for low heights of cut.

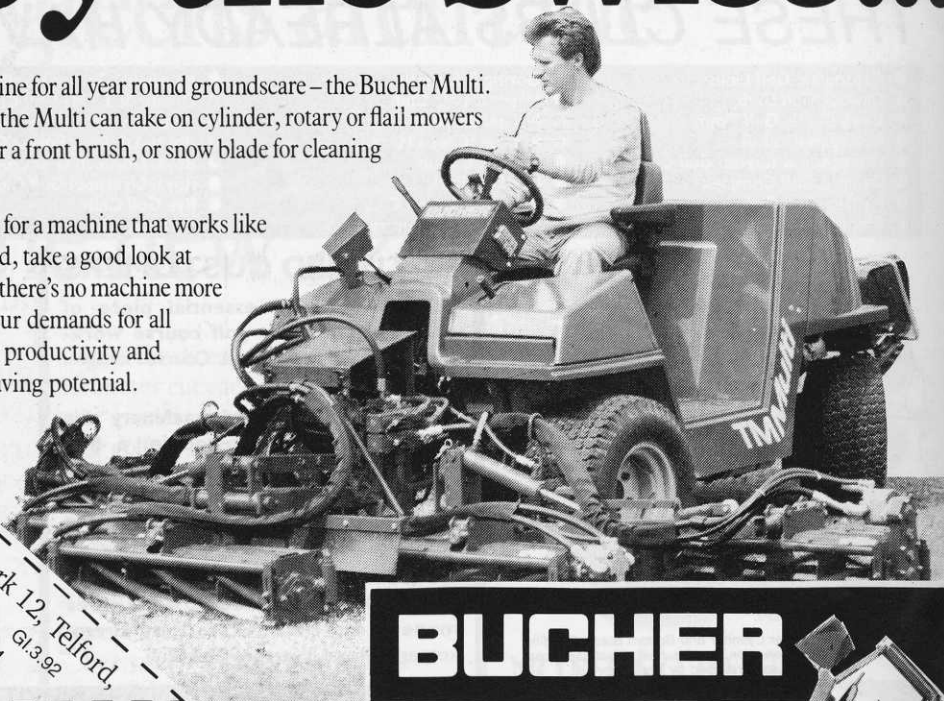
Bedknife angle to the ground

Because the bedbar/bedknife is rotated to adjust the contact/clearance on the moveable bedknife concept, the angle of the bedknife to the ground ('B' on figure 1) changes gradually as the bedknife wears

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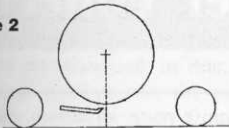
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'It is possible to produce the moveable bedknife concept in a way as to require one adjustment knob'

(and even more gradually as the reel wears). While this angle does not have a precise correct value, under some conditions, this change in bedknife angle may have some adverse effect upon the performance of the mower. Of course, the movable reel concept does not adjust the bedknife angle as the reel and bedknife wear, but on almost all cutting units (regardless of adjustment concept) the bedknife angle changes as the height of cut is changed.

So the angle of the bedknife is dependent upon the height of cut adjustment method as well as the contact/clearance adjustment method. For this reason, many cutting units allow adjustment of both front and rear rollers to adjust the bedknife angle to the optimal range.

Figure 2



Location of bedknife cutting edge

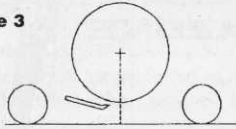
The location of the cutting edge of the bedknife is important in determining how well the cutting unit will cut. The method of adjusting height of cut may cause the bedknife to move forward or rearward as the height is changed, and moving the bedknife rearward as the height of cut is increased will result in better cutting than moving the bedknife forward as the height of cut is increased. If the cutting unit in figure 1 is adjusted by moving only the front roller, the bedknife cutting edge will move forward as the height of cut increases as shown in figure 2.

If the cutting unit is adjusted by moving the rear roller, the bedknife will move rearward as the height of cut is increased as shown in figure 3. Because of this, cutting units which are designed to cut over a wide range of heights must have some method of adjusting the rear roller location to allow the bedknife to move somewhat rearward as the height of cut increases.

The mechanism required to allow adjustment of the reel and bedknife contact or clearance is somewhat different between the two concepts. There are advantages and disadvantages to both concepts.

In the moveable reel concept, the entire reel and its drive mechanism must be moved. In most cutting units with this concept, the reel must be locked in place after adjustment to ensure that the adjustment does not move during use. Also, adjustment is done at each end of the reel independently. Thus, the mechanic must check the adjustment at each end to ensure that it is correct at each end.

Figure 3

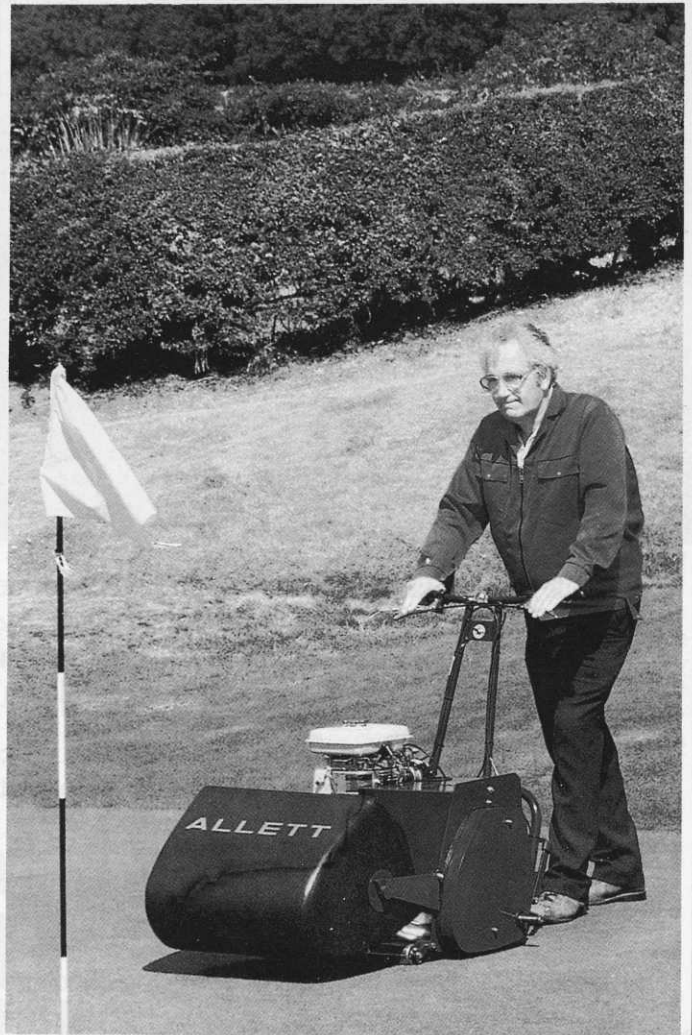


In the moveable bedknife concept, the bedknife/bedbar assembly must be rotated and/or twisted to create the desired adjustment. Many cutting units of this concept are built with the adjustment at each end so that each end is adjusted independently, similar to the moveable reel in this way. However, it is possible to produce the moveable bedknife concept in such a way as to only require one adjustment knob to adjust the clearance of the entire cutting surface, speeding the adjustment process. In order for the single point adjustment method to work, there must be some method to align the bedknife to the reel to allow for manufacturing tolerances in these parts and create the same clearance between the reel and bedknife at each end. This is done by adjusting one of the pivots of the bedbar up or down via an eccentric or moveable pillowblock. The mechanic adjusts for this tolerance once at set-up of the cutting unit, and then only needs to use the single knob to adjust the reel and bedknife contact or clearance.

The moveable reel concept generally requires more structure in order to move the reel and its drive system, while still being able to lock the reel securely in place after adjustment. This heavier structure requires a more rigid cutting unit frame in order to hold the reel securely in place. So while the moveable reel concept allows a more rigid cutting unit frame (because the bedbar may be a torsional structural member), that concept requires a more rigid frame to work successfully. The adjustment system for the moveable knife is generally lighter in weight (while still strong) and often much simpler while still securely holding the parts in place.

Cutting units have been produced for years with both single point adjustment method and individual end adjustment methods and each has advantages and disadvantages. The traditional method was to use individual end adjustment. This method allows the precise adjustment of each end of the cutting unit virtually independent of the other end. This seems good, in that if one end wears more than the other, this can be compensated. However, it requires two adjustments for each cutting unit each time it is adjusted. This is difficult, and unless the person doing the adjusting is very experienced, it is very difficult to tell

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'It is possible to adjust virtually any cutting unit in such a way that frequent backlapping is required to get a good quality of cut'

In search of a perfect cut

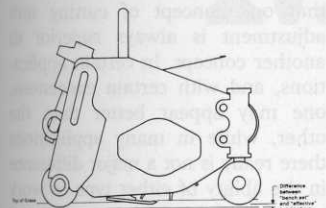
which end needs adjusting unless paper is used as a measuring shim (ie. does it cut or pinch paper?). It has been found that on some machines where some of the adjustments are difficult to reach, the machines are not adjusted properly, but often too tight on one end and too loose on the other (hard to reach) end.

the adjustment has been changed on each machine. However, since the entire bedknife moves when the knob is turned, some other system must be included to allow the bedknife to be levelled to the reel to take up the tolerances which are inherent in grinding the bedknife and reel (whether new or when rebuilding).

adjustment, uneven wear occurs when the two ends are not adjusted equally. This is most pronounced where one end is difficult to reach, and is often not properly adjusted. When uneven wear occurs, the rear roller should be readjusted periodically to be level to the cutting surface of the bedknife to avoid mismatch or differences in height of cut. (Cutting units without an adjustable rear roller will be unable to be set up correctly in this regard.) Field experience has shown that both methods may be used successfully in mower design and construction, when properly executed, and that both methods are successful in the field.

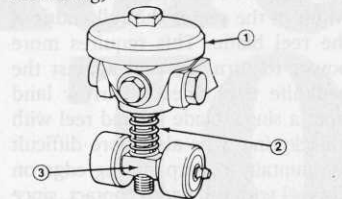
better or worse than the other in regard to the necessity or ease of backlapping. While this may make a good sales position, it is not necessarily true. In fact, it is possible to adjust virtually any cutting unit in a way that backlapping is totally avoided during the life of one bedknife. It is also possible to adjust any cutting unit in such a way that frequent backlapping is required to get a good quality of cut. Experience has shown that it is quite easy to adjust a single point cutting unit at the proper rate to yield a good quality of cut while not requiring any backlapping for the entire wear life of a bedknife.

The need to backlap often has nothing to do with the cutting unit design, but rather with the method of grinding the reel and bedknife cutting surfaces. When the reel is single blade ground, the heights of the blades are not exactly equal after grinding (due to stone wear from the first to last blade). If the bedknife is not ground carefully it can warp, resulting in a non-straight cutting surface after grinding. In these cases, it would be necessary to backlap to establish an acceptable fit between the reel



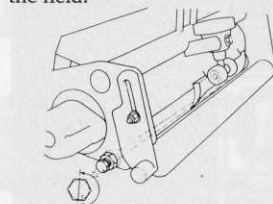
Cutting Unit with single point adjustment.

In an attempt to make adjustment easier, the single point adjustment method was invented. In this concept, one knob moves the entire bedknife toward or away from the reel. The single knob makes the adjustment much easier, since only one adjustment is done for a cutting unit, and in addition, the knob has detents to allow the person doing the adjustment to know how much



Single point adjustment mechanism. 1: bedknife adjusting knob, 2: compression spring, 3: pivot bar

This levelling system is an eccentric bolt or a moveable pillowblock type of arrangement. Experience has shown that once a cutting unit is set up correctly, the bedknife wears at the same rate along the whole length, which means that the adjustment can be completed by only turning the adjustment knob, without having to re-level. On cutting units without the single point



Eccentric bolt to take up tolerances after grinding

To backlap or not to backlap

Sometimes salesmen have presented one type of adjustment as

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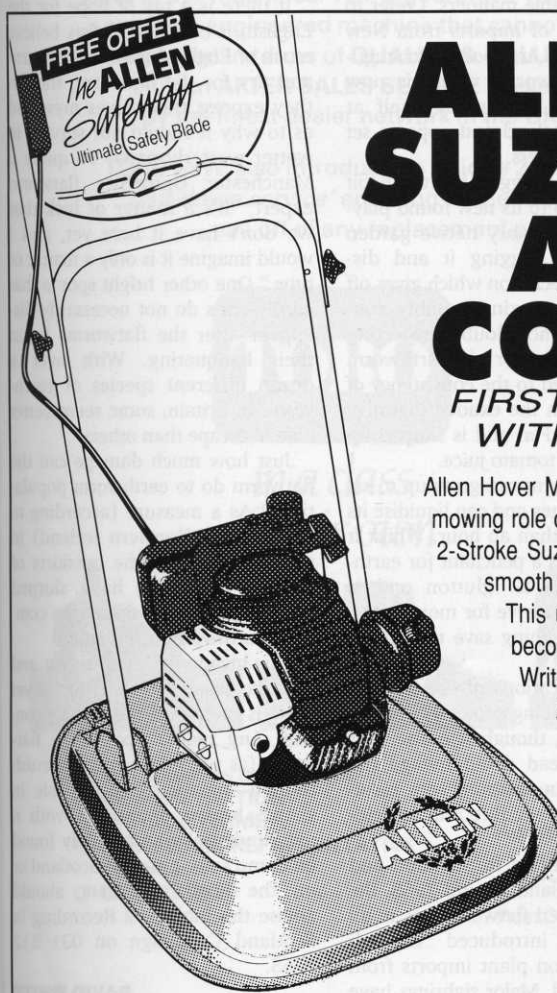
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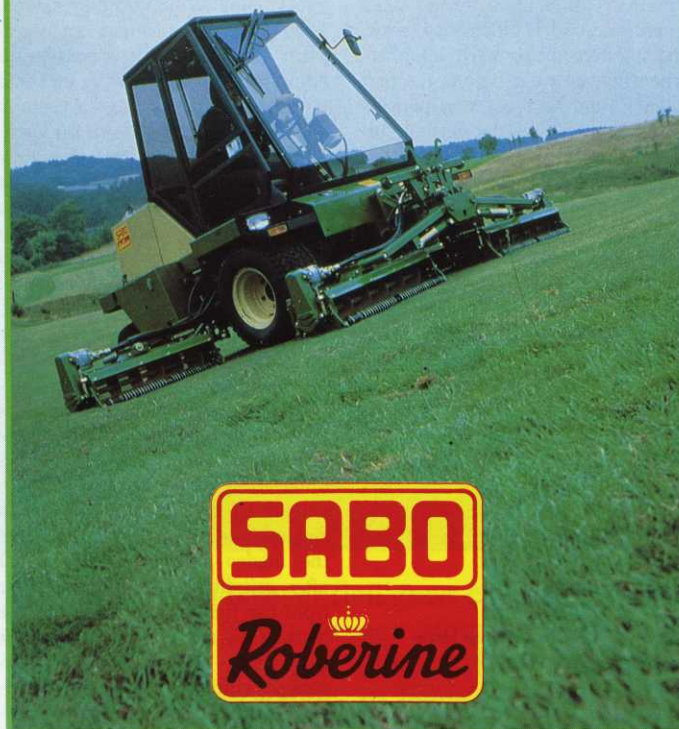
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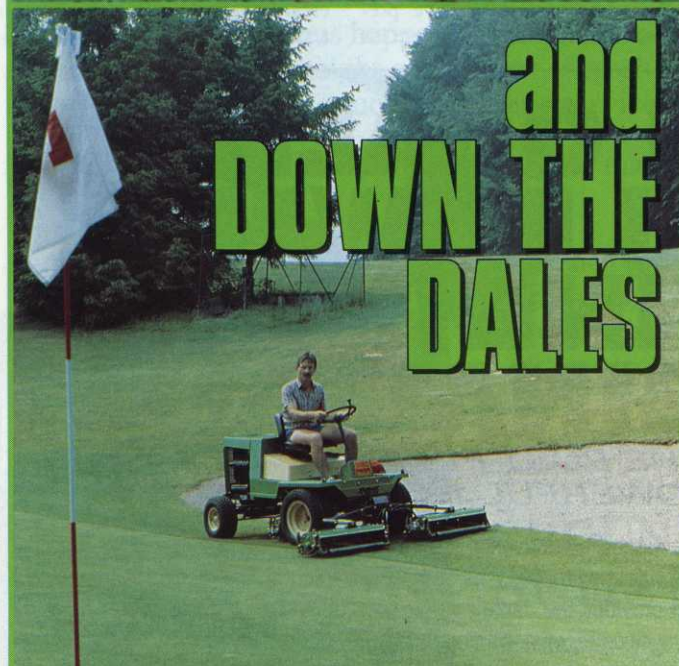
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In search of a perfect cut

and bedknife. If the reel were cylindrically ground, and the bedknife ground carefully, the resulting fits would be acceptable without backlapping.

This does not mean that cylindrical grinding is to be preferred in all cases. With cylindrical grinding it is completely impossible to put a backgrind on the reel. The resulting land width of the reel is the full width of the reel blade. This requires more power to turn the reel against the bedknife than does a narrow land from a single blade ground reel with a backgrind. It is also more difficult to maintain a sharp cutting edge on the reel with full width contact, since more material must be worn away to keep the edge sharp. Because of this, it is more likely that a cylindrically ground reel would require backlap-

ping at some point between grindings than a reel which has backgrind. So there is a place for both types of grinding, but the method will influence the backlap requirements.

Conclusions

There are many factors involved in cutting unit design, and it is not accurate to make a blanket statement that one concept of cutting unit adjustment is always superior to another concept. In certain applications, and with certain executions, one may appear better than the other, while in many applications there really is not a major difference in the ability of either type to work well.

● The author, Fred Wucherpfennig, P.E. is senior principal engineer for the Toro Company.

Disgusting manners of a lesser spotted flatworm

It will be better if you are not reading this over breakfast, for this is the tale of a wee beastly with disgusting table manners. I refer to the nastiest of imports from New Zealand, the *Artioposthia triangulata*, or flatworm, which is now reported to have made itself at home in Scotland and appears set for border reivers.

This little wriggler has the habit of oozing up to its new found playmate: the ordinary native garden earthworm, hugging it and discharging a secretion which gives off a paralysing toxin. Suitably subdued and no doubt expecting romance, the poor old earthworm is then turned to the consistency of soup through the exuded digestive juices of Mr Flat and is slurped up like a can of tomato juice.

The flatworm can grow up to six or seven inches and can liquidise its prey in less than an hour. Whilst it demonstrates a penchant for earthworms, it is no glutton and is reported to survive for months at a time with nothing save the lingering flavour!

The implications of flatworm to the greenkeeping profession are as yet minimal, though scientists fear that its spread could ravage the earthworm population, with resultant harm to wildlife and agriculture.

First identified in Scotland and Northern Ireland around 1965, the mucus-covered flatworm was in all probability introduced through earth clods on plant imports from New Zealand. Major sightings have

been made in garden centres, domestic gardens and some Scottish National Trust properties.

If there is a ray of hope for the English, it is that scientists believe much of England may be too warm and dry for the flatworm, though they express themselves mystified as to why it should not survive in wetter westerly parts. To quote a Manchester University flatworm expert, "It's a matter of luck that we don't have it here yet, and I would imagine it is only a matter of time." One other bright spot is that earthworms do not necessarily disappear after the flatworms begin their banqueting. With over a dozen different species of earthworm in Britain, some seem better able to escape than others.

Just how much damage can the flatworm do to earthworm populations? As a measure (according to scientists in Northern Ireland) in just one field on the outskirts of Belfast, flatworms have slurped their way through almost the complete earthworm community.

This invader is a real threat and must be taken seriously, for as yet there is no known method for control. Any reader spotting a flatworm (as you might expect, flattish though sometimes changeable in shape, brown uppermost with a pale underbelly and usually found on damp soil), either in Scotland or on the English borders, should advise the Biological Recording in Scotland Campaign on 031 312 7765.

DAVID WHITE