

Four Wheel Hoe Blade Length Guide

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1. Introduction

This document explains how blade lengths are determined for interrow hoes and therefore what T hoe blade length you will need for your crops. This is required because it is impossible to supply a standard length hoe blade that will suit everyone, as not only do row widths vary, but so do the size of the crop gap crop types and interrow width consistency, all of which can affect the length of the hoe blade.

As the Four Wheel Hoe is manufactured in different countries by different engineers, there are differences in the approach to supplying hoes. Please visit the Four Wheel Hoe page for your country on the Physical Weeding website www.physicalweeding.com/fourwheelhoe for current information on how blade are supplied. If all of this appears rather daunting all hoes can be supplied with blades that will hoe rows of up to 30 cm / 12" which can then be cut to size following the information in this guide. If you are unsure please feel free to contact us to discuss - our current contact details are on the website.

If you have a diverse range of crops growing on very different sized row widths, more than one pair of hoe blades may be required. This could also apply if you have narrower crop rows but would also like to use the hoe for the false seedbed technique on larger areas of soil, in which case a second larger pair of hoes would be required (see the information page on our website www.physicalweeding.com for details on false seedbeds). Details on prices and how to purchase extra T hoes and other components are on our website.

The rest of this guide outlines the issues that need to be considered when working out the optimum blade length. It may appear rather complicated, especially for such an apparently simple machine, but the underlying principles are relatively straight forward, and they apply to all knife blade hoes.

1. Terminology

For clarity there are a few terms to define.

- **Blade tip**, is the front most part of a T hoe blade i.e., the part closest to the crop row being currently hoed.
- **Blade heel**, is the backmost part of a T hoe blade, i.e., the part closest to the crop row adjacent to the row currently being hoed.
- **Blade length**, is the length of the blade measured along its edge (front or back), i.e., this differs from the interrow width the blade will hoe. For a hoe blade at 60° (as the T hoe is) blade length is twice the interrow width it will hoe.
- **Crop gap**, is the width between the tips of a pair of hoe blades that the crop must fit through. Crop gap is also used to refer to the distance between the blade heel and the adjacent crop row. The minimum size of crop gap that is practically possible to hoe is about 3 cm or just over an inch.
- **Interrow width**, also called row spacing, is the width (measured at 90° to the crop row) between the center of one crop row and its adjacent crop row.
- **Consistent interrow width**, means that the interrow width always remains exactly the same to less than a centimetre / ½" i.e., rows have been marked out using a 'marking out bar' or put in with a multi-row seed drill or planting machine.
- **Variable interrow width**, is the opposite of a consistent interrow width, in that the interrow width frequently varies by more than a centimetre / ½", e.g., each row has be marked out individually.
- **Overlap**, the area of soil between two adjacent crop rows that is hoed twice as the hoe passes down the first row then up the second. Maximising overlap is valuable to maximise weed kill.

2. Ready reckoner

The ready reckoner (Table 1) gives the maximum hoe lengths for a range of interrow widths for small (3 cm) and large (6 cm) crop gaps and the position of the leg along the hoe (see Figure 1).

Table 1. Four Wheel Hoe, blade length ready reckoner. The widths are illustrative as the Four Wheel Hoe is continuously variable for interrow widths above 15 cm. See the following sections and Figure 1 for a full explanation of factors that determine blade length. * = See the detailed information about hoe and frame size limitations in the sections below.

| Interrow width | Max possible blade length | | Leg position length | |
|----------------|---------------------------|---------------|---------------------|---------------|
| | 3 cm crop gap | 6 cm crop gap | 3 cm crop gap | 6 cm crop gap |
| 15 cm / 6" * | 24 cm | 18 cm | 11 cm | 8 cm |
| 20 cm / 8" | 34 cm | 28 cm | 14 cm | 11 cm |
| 25 cm / 10" | 44 cm | 38 cm | 16 cm | 13 cm |
| 30 cm / 12" * | 54 cm | 48 cm | 16 cm | 13 cm |

Blade length is calculated by taking the row width, subtracting the crop gap and then multiplying by two. This assumes an equal sized crop gap at the hoe tip and heel, which would not normally be used in practice, see section 2.1 for an explanation.

Leg position is only indirectly affected by crop width as they are dependent on the hoe width, which varies from 14 cm to 22 cm (measured to the outside of the frame). The leg positions for the 30 cm row are the same as the 25 cm row because room for adjustment of the hoe's width is required, so all of the additional length is added to the back end of the hoe blade.

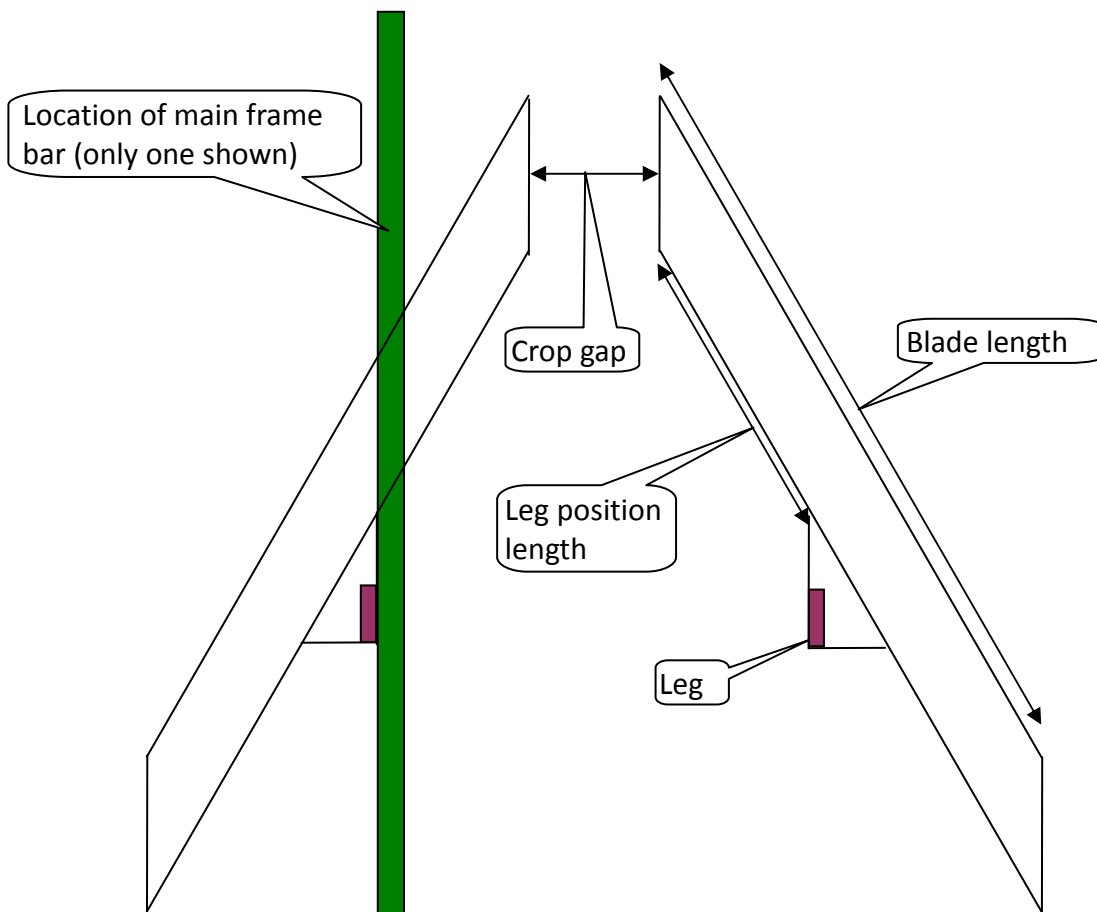


Figure 1. Diagram of pair of T hoes showing how 'blade length' 'leg position length' and 'crop gap' are measured.

All the measurements in Table 1 are based on mounting the hoe leg on the outside of the main frame, which is the standard location. This means that moving both pairs legs to the inside of the frame will reduce the crop gap by 3.6 cm / 1 1/2", which can facilitate using the blades to till the entire soil surface for the false seedbed technique or to give an alternative means of changing from a larger to a smaller crop gap without changing hoe width.

2. Interactions between crop gap, interrow and blade widths

2.1. Crop gaps at the blades tip and heel

As the length of T hoe blades are fixed, as are all hoe blades, i.e., they are not telescopic!, each blade can only hoe a fixed width of soil. Therefore the only way to change the size of the crop gap is to move the hoe blades towards or away from the crop row. The 'problem' with this is that moving the blade away from one row, to increase that crop gap, moves the blade towards the adjacent crop row, decreasing its crop gap. The blade length therefore has to be short enough, so that the distance from the crop row to the blade tip at the widest desired crop gap, is the same as, or less than, the distance from the heel of the hoe to the adjacent crop row Figure 2.

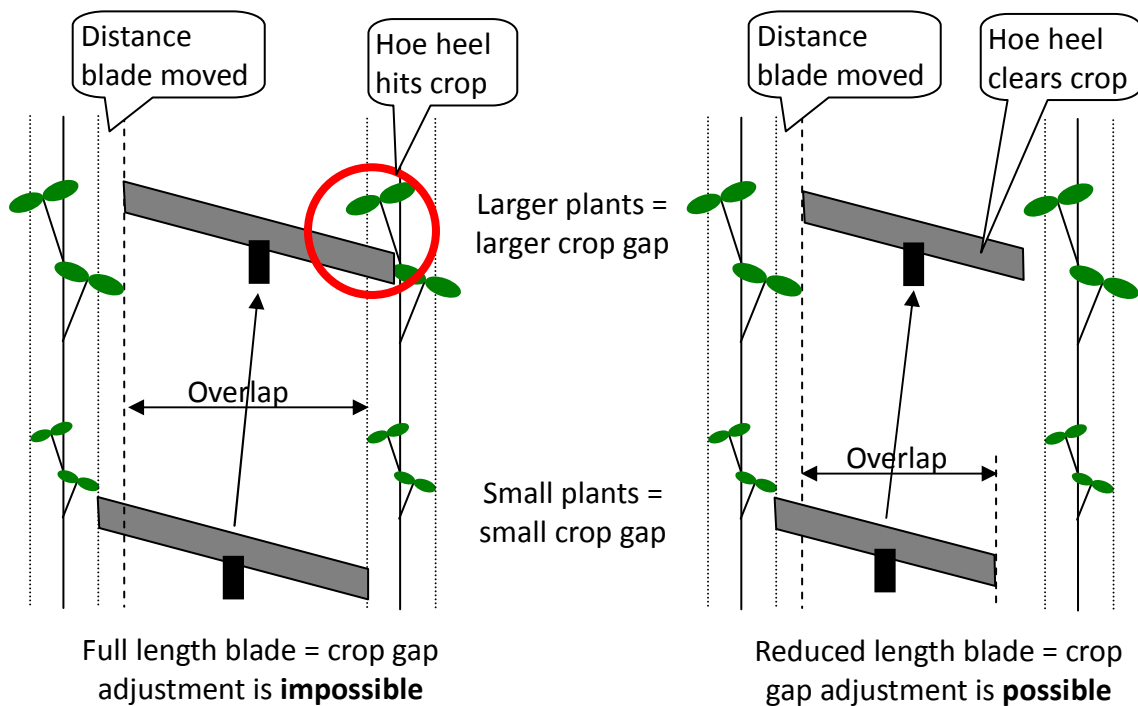


Figure 2. The effect of full or reduced blade lengths on the ability to alter the crop gap.

Generally the crop gap at the blade's heel needs to be larger than at the tip for two reasons: (1) because soil flowing off the blade heel can bury small crop plants; (2) as long as the crop gap at the hoe's heel is bigger than at its tip, if the crop passes through the crop gap at the tips it will pass through the crop gap at the heels.

2.2. Interrow width: consistent or variable

Consistent and variable interrow widths are related to the crop gap issue. If the interrow width is always exactly the same, a hoe that covers the full interrow width can be used without any risk of the hoe heel killing plants in the adjacent crop row. If the interrow width varies, then a full length hoe will hit the plants in the adjacent crop row when the interrow width decreases too much. Therefore, where there is a variable interrow width, such as where rows are marked out individually, for example, using string, or between bouts of tractor mounted equipment, a reduced length hoe blade is required. The optimum length for such a blade is $\frac{2}{3}$ of the full length hoe. This gives the optimum balance between ensuring maximum overlap on successive passes while minimising the chance of killing crop plants in the adjacent row as shown in Figure 3. Clearly a $\frac{2}{3}$ length hoe blade must not be placed centrally in the crop gap but must be positioned towards the center of the hoe to work correctly.

2.3. The practical method to work out your optimum hoe length

Perhaps the most practical approach to cutting your blades to your optimum length is to fit the blades to the hoe but lift them clear of the ground by several centimetres and set the hoe frame to the minimum width you wish to use. Then use a marker pen to draw on the blade at the estimated place to cut them off, both at the tip and the heel, based on the information in Table 1. Then offer the hoe up to a range of crops of different sizes with the hoe set to both minimum and maximum crop gaps to make sure the estimated cutting places are correct. If not, redraw the positions of the cutting lines and then offer the hoe up to the crops again. Repeat until the optimum size is determined. If in doubt cut less off rather than more to start with, and test the hoe for real, as the blades can always be shortened further by cutting off a bit more but it's a rather harder to lengthen a blade by welding bits back on! Always cut the blade parallel to the original ends which are 60° to the blade's edge.

If you have crops grown on significantly different interrow widths, need a wide range of crops gaps, and/or want to hoe crops when their leaves have spread far into the row, one hoe length may not meet your needs and two or more pairs of different lengths and/or leg positions may be required. Please visit our website www.physicalweeding.com for more information on purchasing additional hoe blades and other parts in your country.

2.4. Specific interrow / crop width issues

2.4.1. Fifteen cm / six inch interrow

While it is possible to hoe 15 cm / 6" wide crop rows with the Four Wheel Hoe, this is the absolute minimum row size it can fit down while straddling a single crop row, i.e., the smallest width of the Four Wheel Hoe, from outside tyre-wall to outside tyre-wall, is 13 cm / 5", which leaves only a 3 cm / 1" gap between successive tyre tracks for adjacent crop rows. Therefore, at such interrow widths there is no possibility of increasing the hoe frame width to increase the size of the crop gap, as making the hoe wider means that the wheels will run over the adjacent crop row.

To reduce the width of the hoe that little bit more, one nut from each of the wheel axle bolts between the wheel and main frame can be removed, although this will reduce the locations clamps can be attached to the toolbars as they will hit the tyres on the wheels. Therefore, if different crop gaps are required for 15 cm crop rows, then multiple pairs of T hoes, cut to the required length, will be required for each crop gap size. The exception to this is if one pair of hoes are alternatively clamped on the inside or outside of the toolbar, it will change the horizontal position of each hoe by 1.8 cm / ¾" so altering the crop gap width by 3.6 cm / 1 ½". In addition, if only one blade is moved finer adjustment can be achieved, although the crop gap, and therefore the sight bar, will no longer be in the centre of the hoe which may be confusing when steering.

An alternative approach is to have the hoe straddle two crop rows, however, the standard T hoes and legs will not fit such an approach so custom made hoe legs would be required to reach the central crop interrow. The ancillary benefit of such this approach is that two crop rows are hoed at once so halving the number of passes required. If you are interested in this approach please contact PhysicalWeeding to discuss your requirements (please see our website www.physicalweeding.com for current contact details).

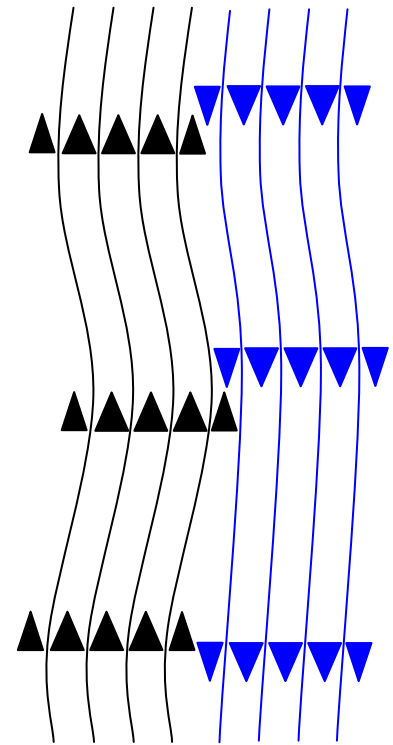


Figure 3. Diagram of how a 1/3 width weeder outside the last row of a bout ensures full ground coverage with a varying inter-bout gap between the black and blue bouts.

2.4.2. Twenty to 25 cm / 8 to 10" interrow widths

Twenty and especially 25 cm / 8 and 10" interrow widths are recommended as the optimum for the Four Wheel Hoe and are also considered the best 'all round' row widths for vegetable production, especially on smaller production scales. At these interrow spacings the maximum amount of width adjustment is available in the Four Wheel Hoe frame, which means for any one blade length the largest range of crop gaps is possible.

2.4.3. Thirty centimetre / 12" and wider row widths

With long enough blades the Four Wheel Hoe can in theory weed any interrow width, even one meters wide. However, practical issues such as human strength and maintaining optimum blade depth mean that a single blade length of 50 cm which will weed a 25 cm wide strip of soil is probably the realistic maximum for a normal strength person to attempt (two 50 cm blades will be weeding a half meter wide strip of soil which is a considerable amount of draft!). For crops that have to be grown in rows larger than 30 cm / 12" especially very large rows e.g., 150 cm / 5' such as pumpkins, it is better to use shorter blades to precisely hoe next to the crop and then longer, overlapping blades, to hoe the interrow area between the crop, which can be done more quickly due to less need to steer precisely. For crops such as brassicas that require intermediate spacings e.g., 40 to 60 cm / 16 to 24", it is almost certainly better to use narrower interrow widths e.g., 25 - 30 cm / 10 - 12" and increase the intrarow (along the crop row) spacing to maintain the correct field populations, rather than trying to grow on, and therefore, hoe, wider crop rows in one pass.

A critical issue for wider interrow widths is not to set the frame at its maximum width at the minimum crop gap, as the crop gap cannot therefore be increased. Decide on the maximum crop gap required, then with the hoe frame at its maximum width, cut the blades to fit that crop gap, so that the crop gap can be decreased to whatever is required. If the largest crop gap is less than 8 cm, then the crop gap can be decreased to zero, or even 'negative size' i.e., the blades overlap, especially if the blades are clamped to the inside of the main frame, which allows them to be quickly changed to hoe a continuous area of soil, e.g., for use in large interrow spaces such as for pumpkins.

2.5. Conclusions

If the above all seems rather confusing, don't panic! Just ask for a pair of the longest hoe blades when you order, fit them to your hoe, and follow the advice in section 2.3, and remember, cutting your hoe blades to the right length is something you only have to do only once, not daily!

Happy Weeding!