TERRACE SPACING

Horizontal Interval

Terrace spacing is the distance between the channels of adjacent terraces. The appropriate terrace spacing is dependent on the type of terrace being planned and the maximum Horizontal Interval (HI). If a parallel terrace system is planned, equipment width must also be considered. Parallel systems should be planned and designed with spacing that allows an even number of passes within the farmable interval.

The terrace cross sections constructed in Nebraska are: 1) Broadbase (includes flat channel terraces), 2) Steep-Backslope, 3) Narrow Base, and 4) Steep-Frontslope. The maximum HI for all terrace systems is the same regardless of the type of being constructed. Factors influencing the HI include: land slope, soil type, tillage operations, and location.

The horizontal interval is that portion of the length of land that is sloped and farmed upstream of the terrace channel. Grassed backslopes of upstream terraces are not included in this length because they are not farmed. Likewise, the channel of terraces constructed with a designed bottom width is not included because it is not sloped toward the terrace.

The equation to calculate the maximum HI is equation 8.2 in Engineering Field Handbook (EFH), Part 650, Chapter 8,

$$HI = (XS + Y)\left(\frac{100}{S}\right) \qquad Eq. 8-1$$

Where:

X = A variable from 0.6 to 0.8. The value of X is based on the geographical location as shown in Fig. 5.

Y = A variable from 1.0 to 4.0. The value of Y is dependent on soil erodibility (K) and planned tillage methods. Table 1 shows values of Y for various soil erodibility and tillage combinations.

S = Average land slope, upstream of the terrace, in ft/100 ft (%)

Table 1

Value of Y in Equation 8-1			
Planned Tillage Operations	K ≤ 0.32	0.32 < K < 0.43	K ≥ 0.43
Conventional Tillage (0 – 15% Residue)	2.50	1.75	1.00
Conservation Tillage (15 – 40% Residue)	3.25	2.5	1.75
No Till (> 40% Residue)	4.00	3.25	2.5

Tables 2, 3, and 4 summarize the maximum HI for Conventional Tillage, Conservation Tillage, and No Till, respectively, for various slopes, soil types, and locations. Terrace spacing should be based on these tables and adjusted as necessary for the planned terrace type.

Farmable Interval (FI)

The farmable interval must be considered if a system of parallel terraces is planned. Determination of the appropriate FI will generally be dependent on the owner/operators equipment used for planting and/or harvest. The FI for parallel terraces should be such that the FI can be covered with an even number of passes with the equipment. Factors to consider in matching the FI to planting equipment include rows planted, row spacing, and points where planting equipment may flex to accommodate grade changes. Harvesting equipment header widths and flex points should be considered when accommodating harvest equipment.

The FI for broadbase terraces is the distance between the ridges of adjacent terraces. This will apply to terraces with "V" channels as well as those with a constructed bottom width.

For Steep Backslope terraces, the FI is the distance between the downstream toe of an upper terrace to the ridge of a downstream terrace. The length of the backslope on the upper terrace is not included because it will be seeded to permanent vegetation.

Both the upstream and downstream embankment slopes of narrow base terraces are seeded to permanent vegetation so the FI is the distance between the downstream toe of the upper terrace to the upstream toe of the lower terrace.

Steep Frontslope terraces are vegetated on the upstream embankment slope so the FI is the distance from the ridge of an upper terrace to the channel of a lower one.

Broadbase Terraces

Parallel

Figure 1 below shows the relationship between the Terrace Spacing, HI, and FI when applicable for parallel broadbase terraces.

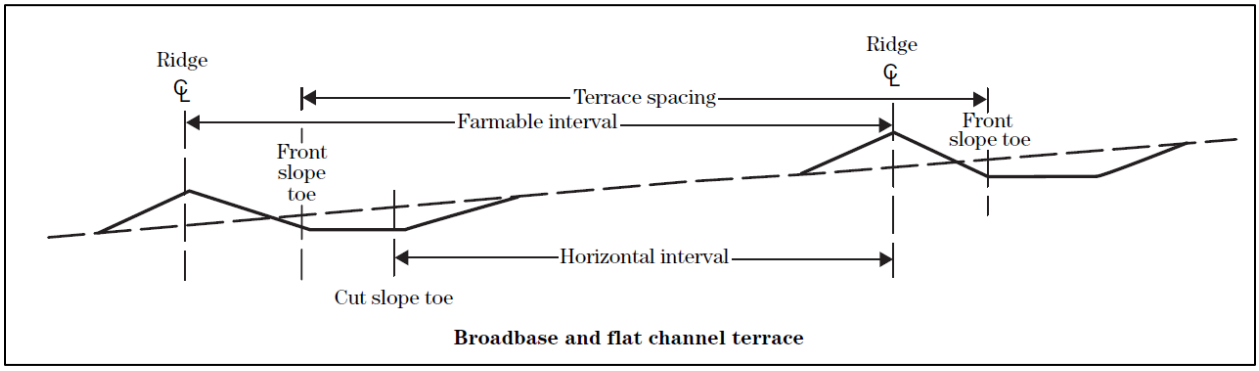

Figure 1

The maximum terrace spacing for parallel broadbase terraces is the maximum Horizontal Interval plus the frontslope length of the upstream terrace plus any designed bottom width in the downstream terrace. The HI can be increased for parallel systems by 15' or 10% of the calculated distance, whichever is greater; to provide a farmable interval that provides an equal number of rounds for planting and/or harvesting. The Farmable Interval is equal to the terrace spacing for broadbase terraces.

Non-Parallel

Because non-parallel terraces will have a variable Farmable Interval and spacing, the terrace must be designed to limit the drainage area contributing to the terrace. For broadbase terraces, the maximum contributing drainage area to the terrace should be calculated as shown below.

$$DA = \frac{L * (FS + BW + HI)}{43{,}560\ \frac{ft^2}{Acre}} \qquad Eq. 8-2$$

Where:

L = Length of Terrace, Ft
FS = Frontslope Length of Terrace, Ft
BW = Bottom Width of Terrace Channel, Ft
HI = Maximum Horizontal Interval, Ft

Steep Backslope Terraces

Parallel

Figure 2 below shows the relationship between the Terrace Spacing, HI, and FI, when applicable, for steep backslope terraces.

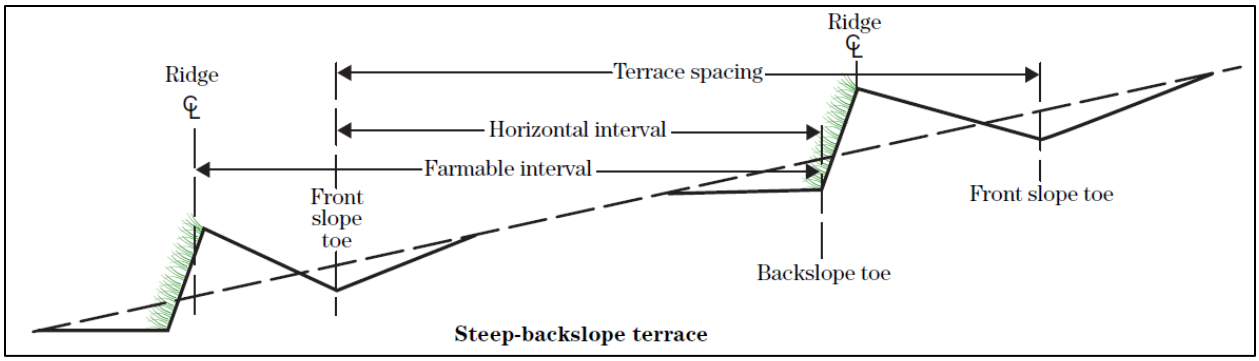

Figure 2

The maximum terrace spacing for steep backslope terraces is the HI plus the backslope length plus the frontslope length of the upstream terrace. The HI can be increased for parallel systems by 15' or 10% of the distance in Table 2 - 4, whichever is greater; to provide a farmable interval that provides an equal number of rounds for planting and/or harvesting. The FI for steep backslope terraces is equal to the HI plus the frontslope length of the downstream terrace.

Non-Parallel

Because non-parallel terraces will have a variable Farmable Interval and spacing, the terrace must be designed to limit the drainage area contributing to the terrace. For Steep-Backslope Terraces, the maximum contributing drainage area to the terrace should be calculated as shown below.

$$DA = \frac{L * (FS + HI)}{43{,}560 \frac{ft^2}{Acre}} \qquad Eq. 8-3$$

Where:

L = Length of Terrace, Ft
FS = Frontslope Length of Terrace, Ft
HI = Maximum Horizontal Interval, Ft

Narrow Base Terraces

Figure 3 below shows the relationship between the Terrace Spacing, HI, and FI (when applicable) for narrow base terraces.

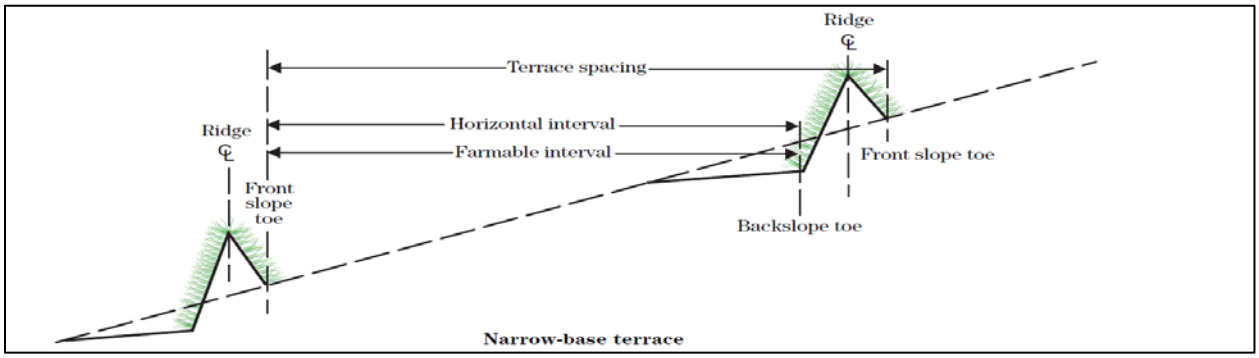

Figure 3

The maximum terrace spacing for narrow base terraces is the HI plus the sum of the backslope length and the frontslope length of the upstream terrace. The HI can be increased for parallel systems by 15' or 10% of the distance in Table 2 - 4, whichever is greater; to provide a farmable interval that provides an equal number of rounds for planting and/or harvesting. The FI for narrow base terraces is equal to the HI.

Non-Parallel

Because non-parallel terraces will have varying a Farmable Interval and spacing, the terrace must be designed to limit the drainage area contributing to the terrace. For Narrow-base terraces, the maximum contributing drainage area to the terrace should be calculated as shown below.

$$DA = \frac{L * HI}{43{,}560 \frac{ft^2}{Acre}} \qquad Eq. 8-4$$

Where:

L = Length of Terrace, Ft

HI = Maximum Horizontal Interval, Ft

Steep Frontslope Terraces

Parallel

Figure 4 below shows the relationship between the Terrace Spacing, HI, and FI (when applicable) for steep frontslope terraces.

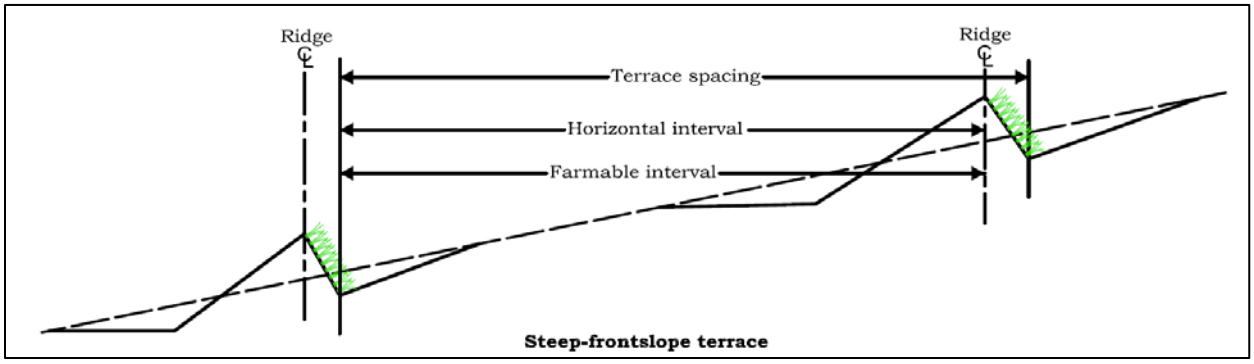

Figure 4

The maximum terrace spacing for steep frontslope terraces is the HI plus the sum of the backslope length and the frontslope length of the upstream terrace. The HI can be increased for parallel systems by 15' or 10% of the distance in Table 2 - 4, whichever is greater; to provide a farmable interval that provides an equal number of rounds for planting and/or harvesting. The FI for Steep-frontslope terraces is equal to the HI.

Non-Parallel

Because non-parallel terraces will have a varying Farmable Interval and spacing, the terrace must be designed to limit the drainage area contributing to the terrace. For steep-frontslope terraces, the maximum contributing drainage area to the terrace should be calculated as shown below.

$$DA = \frac{L * HI}{43{,}560 \frac{ft^2}{Acre}} \qquad Eq. 8-4$$

Where:

L = Length of Terrace, Ft

HI = Maximum Horizontal Interval, Ft

Table 2

Maximum Horizontal Interval (HI)
Conventional Tillage (0 - 15% Residue)

		K ≤ 0.32			0.32 < K < 0.37			K ≥ 0.37		
[1] X factor:		0.8	0.7	0.6	0.8	0.7	0.6	0.8	0.7	0.6
[2] Y Factor:		2.50			1.75			1.00		
Average Land Slope (%)	1	330	320	310	260	250	240	180	170	160
	2	210	200	190	170	160	150	130	120	110
	3	160	150	140	140	130	120	110	100	90
	4	140	130	120	120	110	100	110	100	90
	5	130	120	110	120	110	100	100	90	80
	6	120	110	100	110	100	90	100	90	80
	7	120	110	100	110	100	90	90	80	70
	8	110	100	90	100	90	80	90	80	70
	9	110	100	90	100	90	80	90	80	70
	10	110	100	90	100	90	80	90	80	70
	11	100	90	80	100	90	80	90	80	70
	12	100	90	80	90	80	70	90	80	70
	13	100	90	80	90	80	70	90	80	70
	14	100	90	80	90	80	70	90	80	70
	15	100	90	80	90	80	70	90	80	70
	16	100	90	80	90	80	70	90	80	70
	17	90	80	70	90	80	70	90	80	70
	18	90	80	70	90	80	70	90	80	70
	19	90	80	70	90	80	70	90	80	70
	20	90	80	70	90	80	70	90	80	70

Notes:

1. X Factor is a geographic location factor. See Figure 5.
2. Y Factor is factor to account for soil type and planned tillage operations. See Table 1.

Table 3

Maximum Horizontal Interval (HI)
Conservation Tillage (15 - 40% Residue)

		K ≤ 0.32			0.32 < K < 0.37			K ≥ 0.37		
[1] X factor:		0.8	0.7	0.6	0.8	0.7	0.6	0.8	0.7	0.6
[2] Y Factor:		3.25			2.50			1.75		
Average Land Slope (%)	1	410	400	390	330	320	310	260	250	240
	2	240	230	220	210	200	190	170	160	150
	3	190	180	170	160	150	140	140	130	120
	4	160	150	140	140	130	120	120	110	100
	5	150	140	130	130	120	110	120	110	100
	6	130	120	110	120	110	100	110	100	90
	7	130	120	110	120	110	100	110	100	90
	8	120	110	100	110	100	90	100	90	80
	9	120	110	100	110	100	90	100	90	80
	10	110	100	90	110	100	90	100	90	80
	11	110	100	90	100	90	80	100	90	80
	12	110	100	90	100	90	80	90	80	70
	13	110	100	90	100	90	80	90	80	70
	14	100	90	80	100	90	80	90	80	70
	15	100	90	80	100	90	80	90	80	70
	16	100	90	80	100	90	80	90	80	70
	17	100	90	80	90	80	70	90	80	70
	18	100	90	80	90	80	70	90	80	70
	19	100	90	80	90	80	70	90	80	70
	20	100	90	80	90	80	70	90	80	70

Notes:

1. X Factor is a geographic location factor. See Figure 5.
2. Y Factor is factor to account for soil type and planned tillage operations. See Table 1.

Table 4

Maximum Horizontal Interval (HI)
No Till (> 40% Residue)

		K ≤ 0.32			0.32 < K < 0.37			K ≥ 0.37		
[1] X factor:		0.8	0.7	0.6	0.8	0.7	0.6	0.8	0.7	0.6
[2] Y Factor:		4.00			3.25			2.50		
Average Land Slope (%)	1	480	470	460	410	400	390	330	320	310
	2	280	270	260	240	230	220	210	200	190
	3	210	200	190	190	180	170	160	150	140
	4	180	170	160	160	150	140	140	130	120
	5	160	150	140	150	140	130	130	120	110
	6	150	140	130	130	120	110	120	110	100
	7	140	130	120	130	120	110	120	110	100
	8	130	120	110	120	110	100	110	100	90
	9	120	110	100	120	110	100	110	100	90
	10	120	110	100	110	100	90	110	100	90
	11	120	110	100	110	100	90	100	90	80
	12	110	100	90	110	100	90	100	90	80
	13	110	100	90	110	100	90	100	90	80
	14	110	100	90	100	90	80	100	90	80
	15	110	100	90	100	90	80	100	90	80
	16	110	100	90	100	90	80	100	90	80
	17	100	90	80	100	90	80	90	80	70
	18	100	90	80	100	90	80	90	80	70
	19	100	90	80	100	90	80	90	80	70
	20	100	90	80	100	90	80	90	80	70

Notes:

1. X Factor is a geographic location factor. See Figure 5.
2. Y Factor is factor to account for soil type and planned tillage operations. See Table 1.

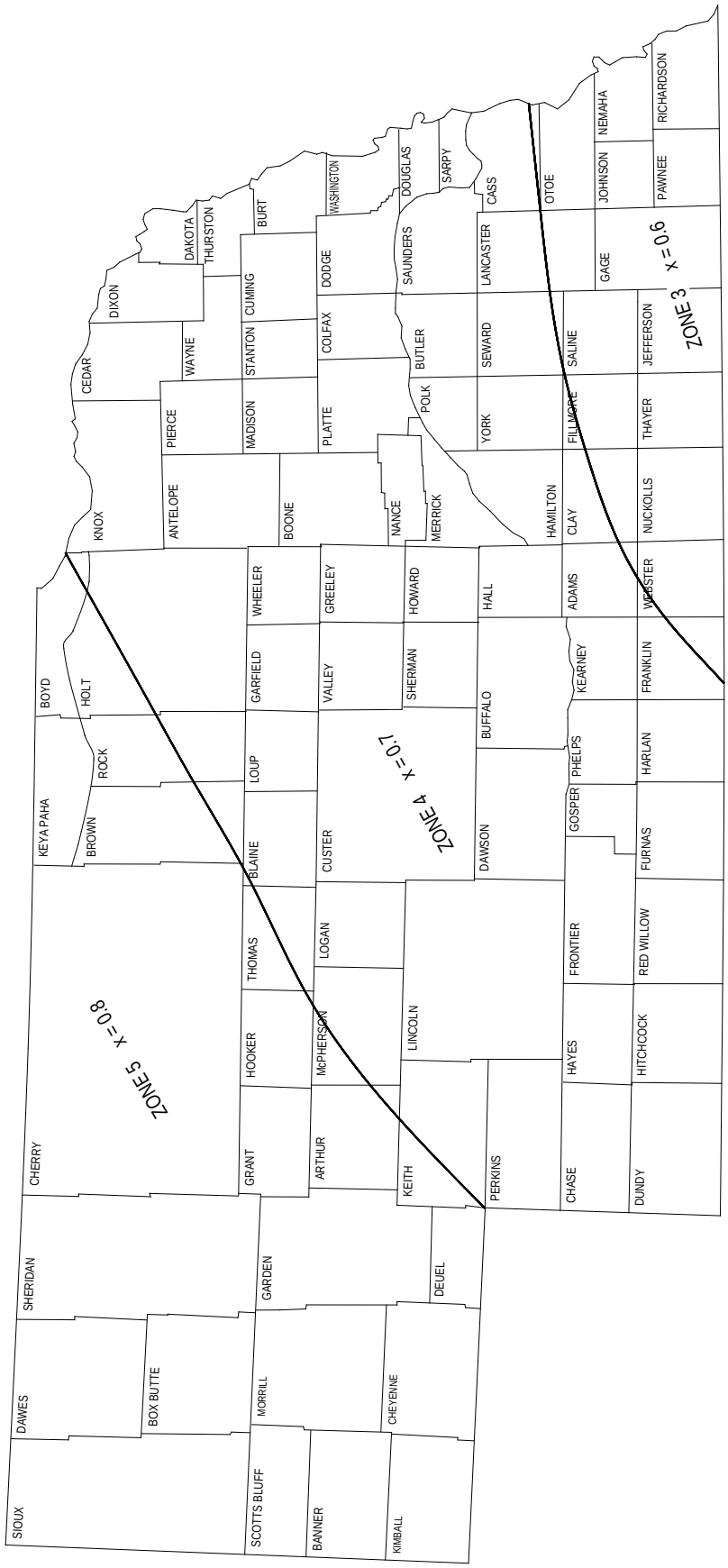

FIGURE 5

VALUES OF x IN EQUATION: V.I.= xs + y OR H.I. = (xs +y) (100/S)

Examples

Example 1

A parallel broadbase terrace system is planned on a field with 5% average slope in Dodge County. The operator has a 12 row planter with 30" rows. The predominant soil is a Moody Silty Clay Loam. The conservation plan requires Conservation Tillage (15 – 40% residue). What is the maximum terrace spacing?

Determine Maximum Terrace Spacing

X Factor = 0.7	*From Figure 5, Dodge County, NE*
Soil Erodibility Factor (K) = 0.32	*From Soil Survey*
Y Factor = 3.75	*Table 1 with K ≤ 0.32 & Conservation Tillage (15 – 40% Residue)*
Max. Horizontal Interval (HI) = 140 ft.	*Table 3 (Conservation Tillage), 5% slope, K ≤ 0.32, X = 0.7*
Frontslope length = 30 ft	*1 planter width @ 12 – 30" rows*
Backslope length = 30'	*Assume 6' maximum fill @ 5:1 slope*

Maximum Spacing = Maximum Horizontal Interval (HI) + Frontslope Length + Bottom Width
= 140 ft + 30 ft + 0 ft
= 170 ft

Because the FI is equal to the terrace spacing for broadbase terraces, the FI is 170'. Because 170' is not a multiple of 30', the HI can be increased up to 15'or 10% whichever is greater to accommodate equipment. Because 10% of the allowable HI is 14' (10% of 140 ft), the HI can be increased up to 15 ft.

Terrace Spacing used= HI + Adjustment + Frontslope Length + BW
= 140' + 10' + 30' + 0'
= 180'.

Example 2

A parallel steep backslope terrace system is planned on a field with 10% average slope in Otoe County. The operator has a 12 row planter with 30" rows. The predominant soil is a Pawnee Clay Loam. The conservation plan requires No Till (>40% residue). What is the maximum terrace spacing?

Determine Maximum Terrace Spacing

X Factor = 0.6	Figure 5, Otoe County, NE
Soil Erodibility Factor (K) = 0.32	Soil Survey
Y Factor = 4.00	Table 1 with K $\leq$ 0.32 & No-Till (> 40% Residue)
Maximum Horizontal Interval (HI) = 100ft.	Table 4 (No-Till), 10% slope, K $\leq$ 0.32, X = 0.6
Frontslope length = 30 ft	1 planter width @ 12 – 30" rows
Backslope Length = 12'	Assume 6' fill at 2:1 slope

Maximum Spacing = Maximum Horizontal Interval (HI) + Frontslope Length + Backslope Length
= 100 ft + 30 ft + 12 ft
= 142 ft

The FI for steep-backslope terraces is equal to the HI plus the frontslope length or 130'. Because 130' is not a multiple of 30', the HI can be increased by the greater of 15' or 10% of the HI. 150' is the next higher multiple of 30'. Since 15' is greater than 10% of 100, it can be adjusted up to 15', or 145'. Since this is less than 150', the HI should be decreased by 10' to 90' to provide a FI of 120'.

Terrace Spacing used= HI + Adjustment + Frontslope Length + BW
= 100' + (-10') + 30' + 0'
= 120'