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## **MANUAL FOR RECOVERY OF TERRACES**

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**Manual is based on few references and on lot of experiences gathered in years of making new vineyards and orchards on terrases.**



# Vineyards surface



	<b>Goriška Brda</b>	<b>Vipavska dolina</b>	<b>Kras</b>	<b>Slovenska Istra</b>	<b>total Primorska</b>
<b>vineyards (ha)</b>	<b>1 947</b>	<b>2 566</b>	<b>590</b>	<b>1 452</b>	<b>6 555</b>
<b>vineyards on terraces (ha)</b>	<b>1 519</b>	<b>1 770</b>	<b>83</b>	<b>261</b>	<b>3 633</b>
<b>%</b>	<b>78</b>	<b>69</b>	<b>14</b>	<b>18</b>	<b>55</b>

<b>Vine growing region</b>	<b>Year precipitation (mm)</b>	<b>Precipitation in growing season (mm)</b>	<b>Precipitation in growing season (%)</b>
<b>Goriška brda</b>	<b>1600</b>	<b>984</b>	<b>61,4</b>
<b>Vipavska dolina</b>	<b>1507</b>	<b>910</b>	<b>60,4</b>
<b>Kras</b>	<b>1573</b>	<b>938</b>	<b>59,7</b>
<b>Slovenska Istra</b>	<b>1058</b>	<b>683</b>	<b>65,0</b>
<b>average</b>	<b>1434</b>	<b>879</b>	<b>61,6</b>

**Precipitation in july and august are very low.**

**Drought is very often also for vine.**

**There are local showers with high intesity (30 - 50 – 100 mm/h)**



**Runoff is very high  
and rainfall is not  
efficient enough for  
vines.**

**Result of showers  
is erosion of soil.**



**In the past our farmers use the flat land for the production of food for people and animals (cereals, potatoes, maize, foam...).**

**They planted vineyards and orchards on gentle to steep slope, where are higher temperatures, the soil warms faster, there are no risk of frost and the occurrence of diseases is smaller.**

**They made a kind of terraces by hand to preserve water and prevent erosion.**

**Terraces were changed a little with the appearance of tractors, bulldozers, air sprayers and other mechanisation.**

**First terraces were made by ploughing with big plough pulled by two bulldozers on slopes less than 40 %.**

**Later and on steep slopes the terraces were made by moving soil with bulldozer blades and dig by them.**

**Nowadays terraces are made by bulldozers and then finished by diggers.**





**Before starting construction of the terraces it is necessary to choose the proper distances (between rows and within rows) of planting vine grafts, growing system, vine varieties which depends of soil and position.**

**It is also necessary to decide how the slopes of the terraces will be maintained and what kind of agricultural tractor and mechanisation will be used.**

**All factors together define width of the terrace plane.**

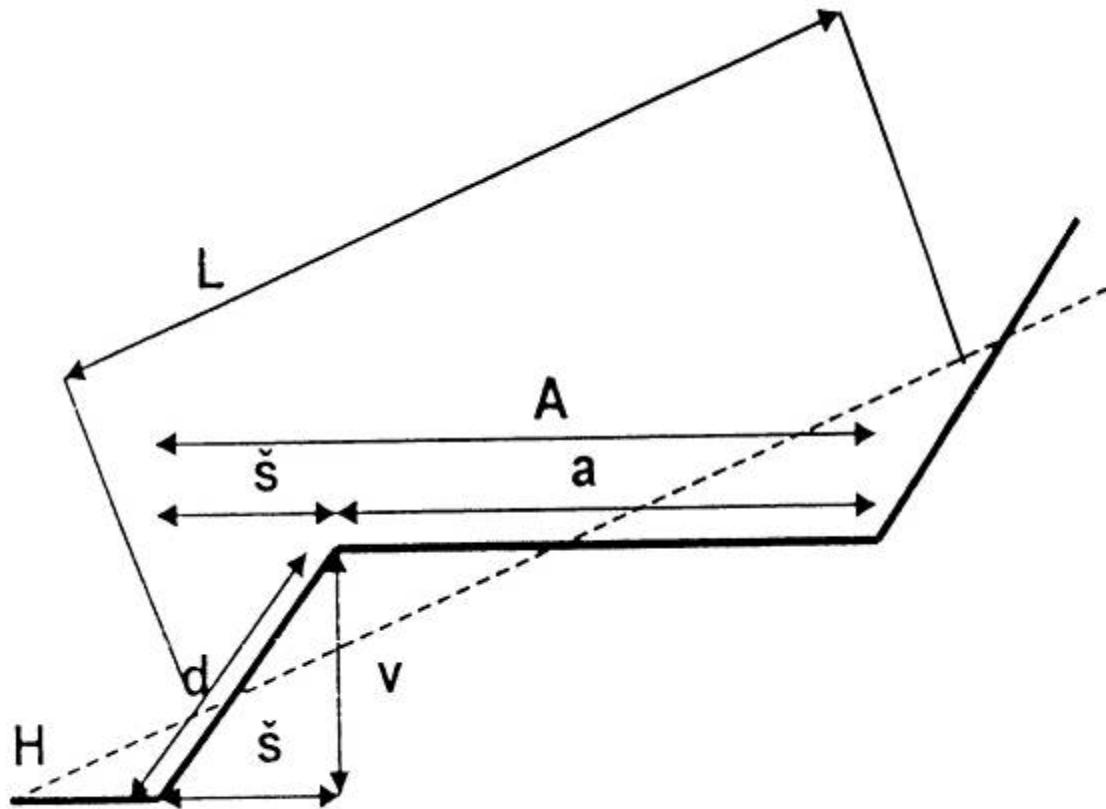
## Elements of the terrace

**H** - Inclination of the land

**A** - Width of the terrace

**a** - Width of the terrace plain

**š** - Width of the terrace slope



**v** - Height of the terrace slope

**d** - Length of the slope

**L** - Distance between the poles

**The inclination of the slopes is determined by the type of soil and must be selected so, that doesn't occur demolition of the slopes, which should be greened and overgrown fast.**

**In our climate conditions and for flysch light soil is proposed the ratio between height and width of the slope 1:1 and for heavy clay soil 1:1,5.**

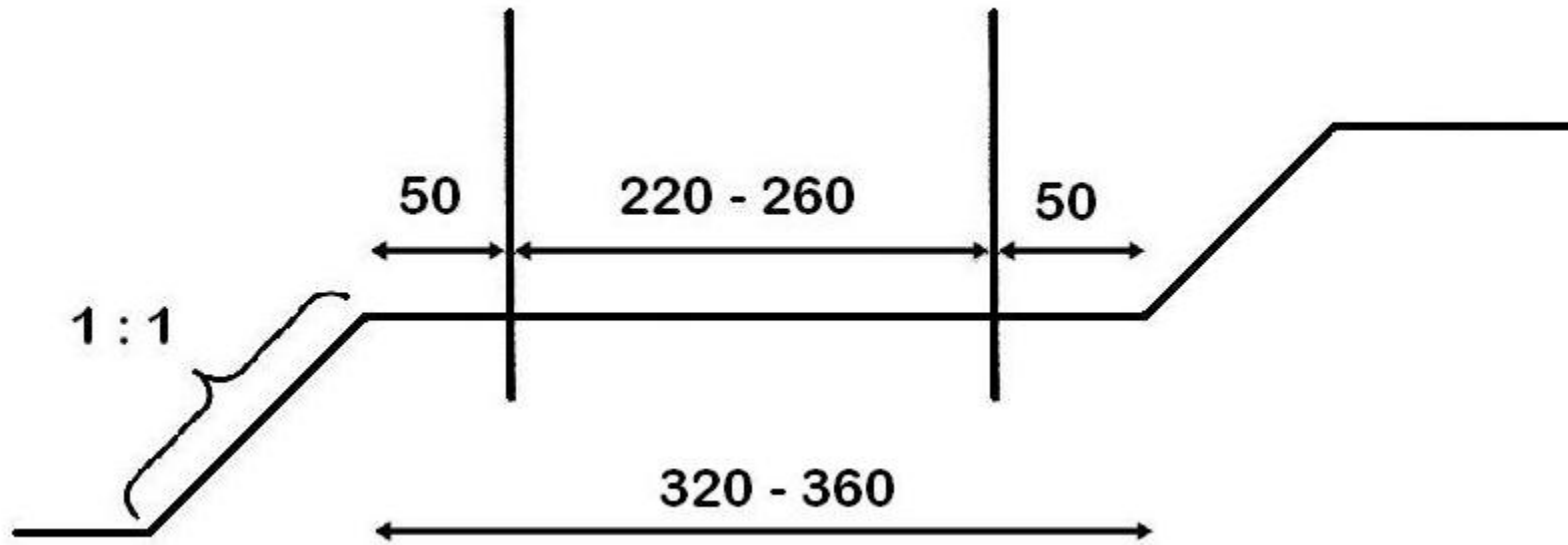


# The most frequent types of terraces are:

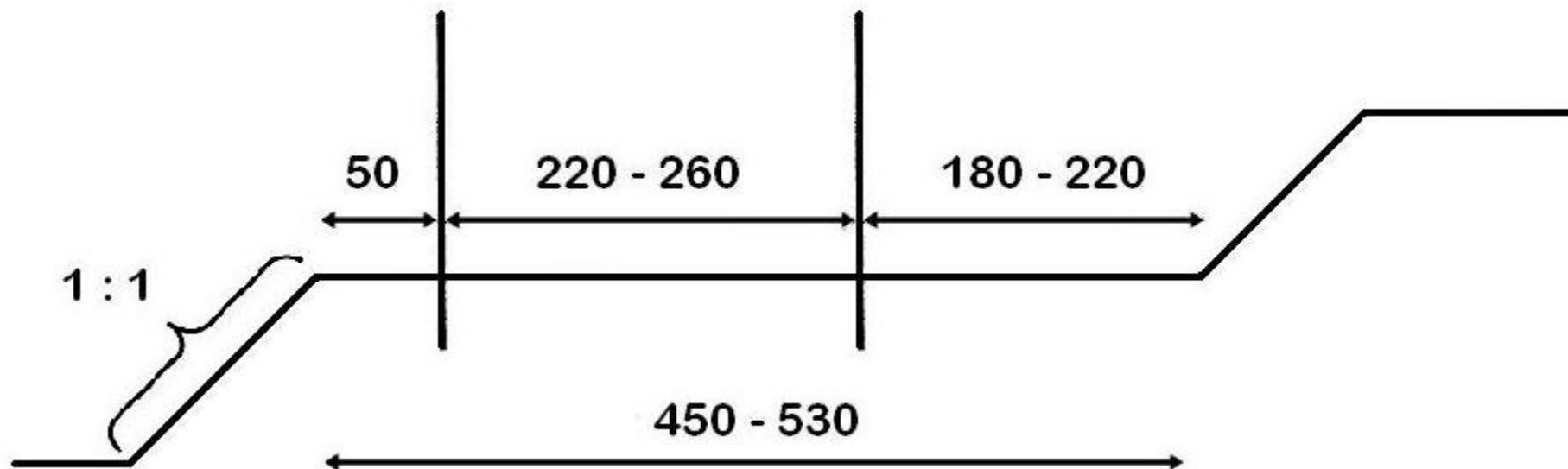
## One row terrace



# Two row terrace



# Two row terrace with passage for tractor under the slope



**In all cases distances are approximate and depend of width of tractor and the distance of the row from edge of slope.**



**We developed an equation and prepared tables for checking the parameters of the terraces from % of inclination, which can be measured easily. So we can make decisions easier.**





**Inclination has influence on possible width of the plain of the terrace, width and height of the slope and defines % of useful surface for vines.**

**Length of the slope depend of inclination and width of the terrace plain. When it is known, is possible to decide, how to maintain or cultivate the slope and which mechanisation can be used.**



## Influence of the inclination on width and height of the slope and width of the terrace at selected width of the terrace plain

<b>INCLINATION</b>	<b>ONE ROW TERRACE a = 2,30 m</b>	<b>TWO ROW TERRACE a = 3,50 m</b>	<b>EXTENDED TWO ROW TERRACE a = 5,00 m</b>
<b>15%</b>	A=2,70 m d = 0,57 m v = 0,41 m	A = 4,12 m d = 0,87 m v = 0,62 m	A = 5,88 m d = 1,24 m v = 0,88 m
<b>30%</b>	A=3,30 m d = 1,40 m v = 1,00 m	A=5,00 m d = 2,12 m v = 1,50 m	A=7,14 m d = 3,00 m v = 2,14 m
<b>50%</b>	A=4,60 m d = 3,25 m v = 2,30 m	A=7,00 m d = 4,95 m v = 3,50 m	A=10,00 m d = 7,00 m v = 5,00 m

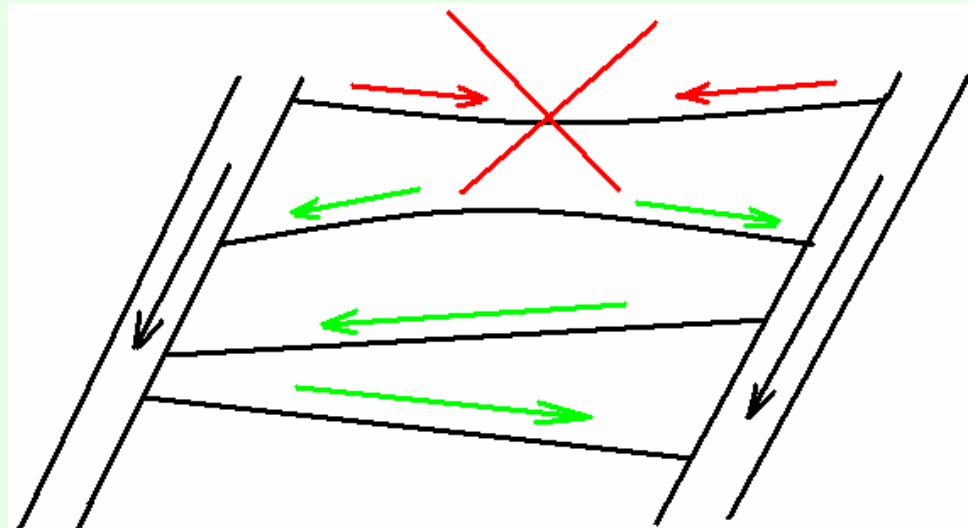


# Terraces making

- cutting down trees, bushes or old vines, uprooting, digging up roots and elimination all wooden parts from soil to prevent the attack of parasitic fungi



**- levelling the ground**  
**- Determination of first terrace direction at the top of parcel with proper inclination along the terrace. The inclination along the terrace should be from 0,5 to 2 % or a little bit more in one direction or from the middle to both ends of terrace. Such inclination ensure the run off surpluses of water to prevent damages of terraces or erosion of slopes.**



**Near the end of the terrace the inclination can be up to 5 - 7%**



## -making the first terrace by bulldozer



-The terrace plane must be horizontal or with a little inclination in the direction to the hill; water should not run off over the slopes, because it makes erosion.



- marking of terrace plain and slope by poles and making other terraces by bulldozer
- fertilizing with phosphorus and potassium if the soil needs
- digging the soil by digger





**- making slope under the selected inclination by digger**







# Road making

Road width should be 3 – 4 m

Road for turning round should be minimal 5 m

Inclination:

Road for two wheel drive tractor should be less than 15 %.

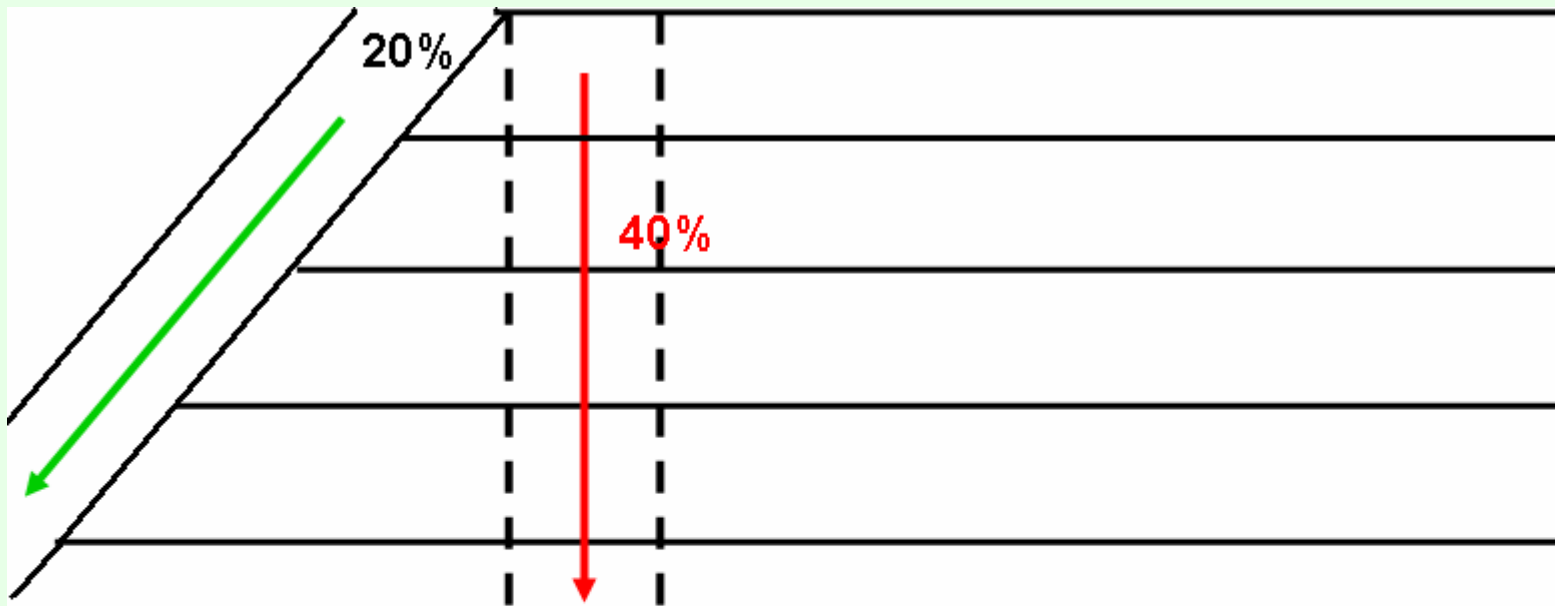
Road for four wheel drive tractor should have inclination about 20 – 22 %



**Road for turning round up to 25 % for two wheel drive tractors and up to 30 % for four wheel drive tractors**

**The curve of the road must be made without or with minimal inclination to make possible transport of heavy load up the slope.**

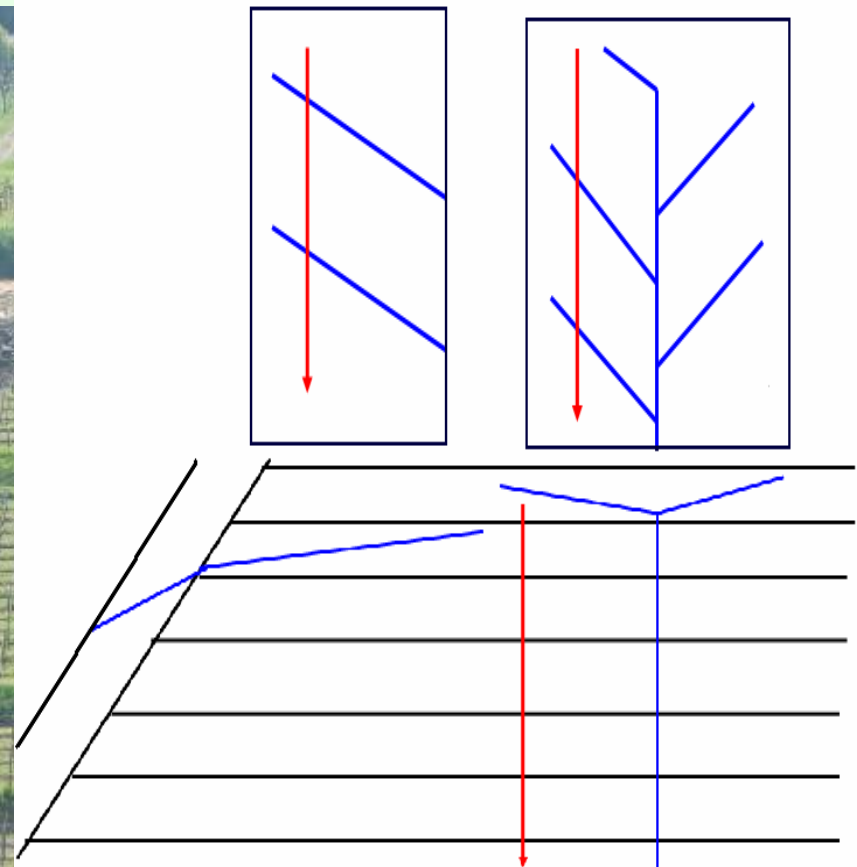




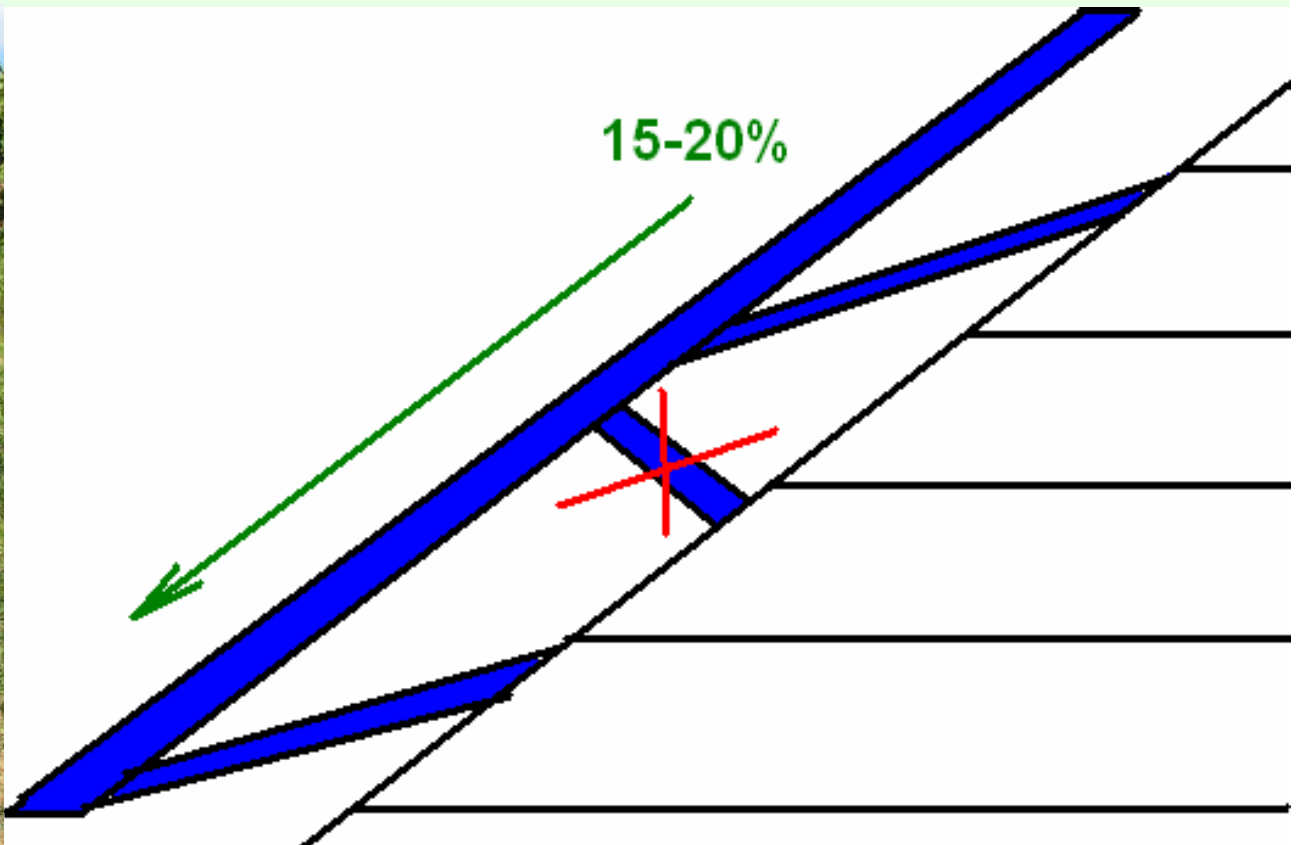
**The inclination of the road is possible to make more suitable by changing direction.**

**Well made roads represent the conditions for safe and effective work with mechanisation.**

**In case of muddy soil or underground spring a drainage must be made by perforated plastic tube and gravel stone filter.**



**Run off surface water must be controlled to keep the roads without erosion.  
Water must be directed to channel or sewer trough the gutter with grid.**





**Shall we keep the viticulture on terraces or shall we loose it?**

**In general the answer depends of the economic situation in winegrowing sector.**

**Our task is to give technological advises to vine growers, that they can reduce their costs and amount of manual working hours to maintain terraces.**

**The reduction of costs is possible to achieve during the renewal or construction of new vineyard on terraces.**

**Thank you for your attention !**

