## 7 TURKEY – ESKESHIR: TERRACING & CONTOUR TILLAGE

The hill slope areas near Eskisehir suffer from soil erosion.

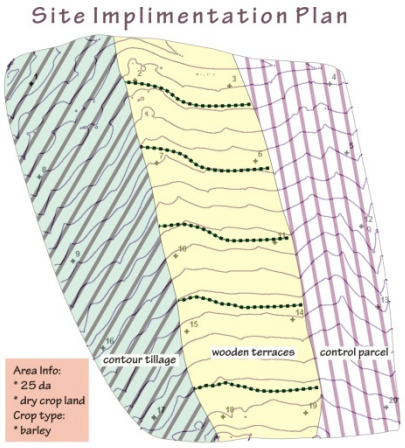
The area is semi -arid, soils are shallow, stony and organic matter content is low. Land use is rainfed wheat with occasional fallow periods. Late spring and early summer rainfalls are particularly erosive.

Experiments were carried out that interrupt the runoff and help increase infiltration and thereby increasing soil moisture storage. The overall objective is to decrease surface runoff and to reduce soil losses.

### THE EXPERIMENT: TERRACING AND COUNTOUR TILLAGES

Two technologies (contour ploughing and terracing) were investigated for water retention and crop growth against the conventional cultivation practice during the period December 2009 and July 2011.

Terracing in this context means that shallow levees were made along the contour lines (dashed lines in the drawing to the left). Poles are hammered on top and branches are woven between them This potentially stops the sediment and slows down runoff and when left continuously, a sloping terrace would eventually form. The tillage between these fences is along the contours. The left hand plot was done with contour ploughing only. The right hand plot uses the conventional tillage along the slope as it gives the longest seed lines.

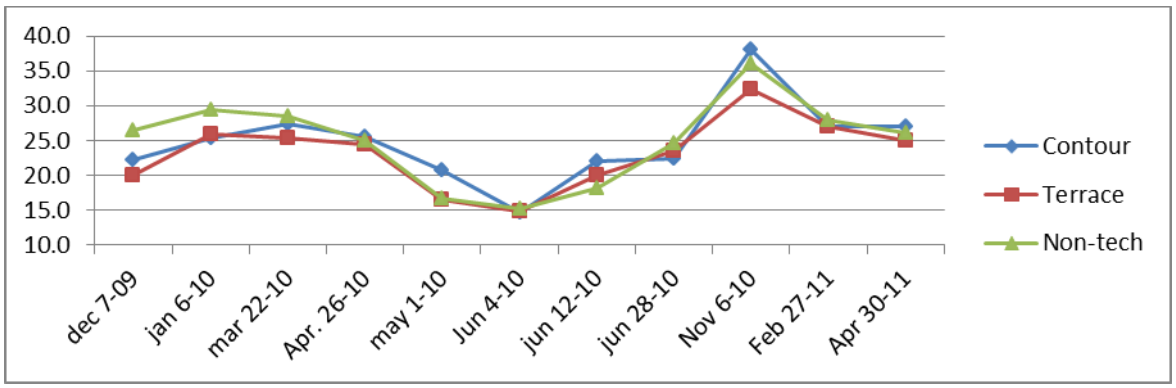



| | 2009 | 2010 | 2011 |
|---|---|---|---|
| Moisture Electrical conductivity | | | |
| Temperature | | | |
| Germination rate | | | |
| Crop yield Expenses | | | |
| Incomes | | | |

Soil parameters such as moisture content and electrical conductivity were measured regularly with a portable TDR at pre-defined locations (12 per plot), apart from germination rate and crop yield observations (see table below). Germination rate is determined by counting the individual sprouts in $m^2$ once within January in the early sprouting period. Crop yield assessment was made during the harvest at the end of growing season.

## RESULTS

The result shows that the water content (WC) of the soils vary seasonally. During the monitoring period (Nov 2009 – June 2011) contour tillage technology results in a slightly higher WC (Figure below). Terracing gives second best results though non-technology area exhibit higher WC in the winter months. The differences might also be caused by soil variation. In any case, the differences are not significant, certainly not in a sense of crop water availability.

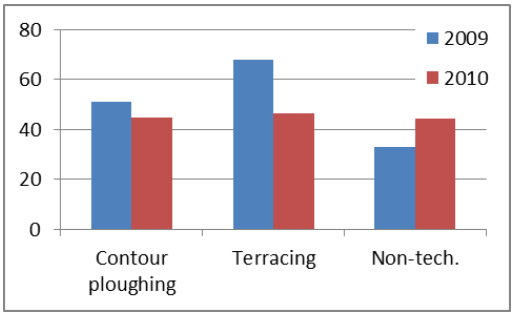



*Average moisture content (12 measurementsper moment per treatment) during the experiment.*

It appears that during the first year, seed germination rate was the highest in the terraced plot as compared to contour and conventional tillage, while in the second year these differences were not observed. This shows that inter-annual variability is sometimes large and not all effects should be contributed to the technology.

Finally, crop yield in the terrace and contour tillage plots is increased by 2-3 times. While this can be explained by a better germination in 2009, there is no clear explanation for 2010. There might be moisture differences deeper in the soil that are not detected.

During the two years there were no direct erosion events on the plots, However a neighbouring unprotected field showed heavy rills which were seen on the experimental slope.




*Germination rate winter Barley in January in sprouts/m²*

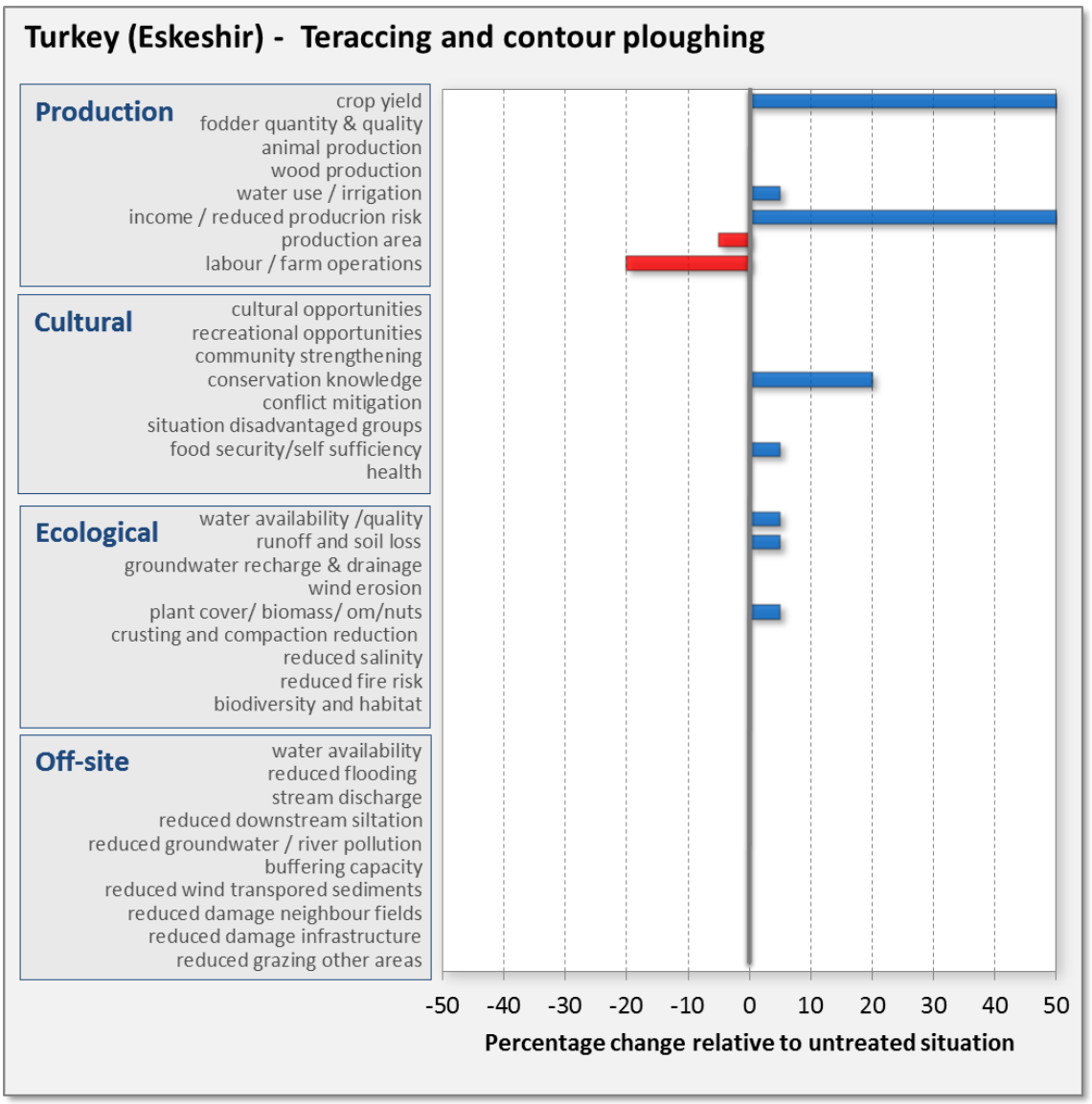
| Harvest / collection date | technology | Area (ha) | Crop type | Quantity (kg/ha) | Income (per ha) | Quantity (kg/ha) | Income (per ha) |
|---|---|---|---|---|---|---|---|
| | | | | 2009 | | 2010 | |
| 07-07-10 | Terrace | 1.15 | barley-grain | 1652 | 634 | 1304 | 501 |
| 07-07-10 | Terrace | 1.15 | straw | 609 | 61 | 635 | 63 |
| 07-07-10 | Terrace Total | | | | *(293)* **695** | | *(512)* **564** |
| 07-07-10 | Contour tillage | 0.82 | barley-grain | 756 | 290 | 1829 | 702 |
| 07-07-10 | Contour tillage | 0.82 | straw | 366 | 37 | 762 | 77 |
| 07-07-10 | Contour tillage Total | | | | *(293)* **327** | | *(574)* **779** |
| 07-07-10 | Control | 0.8 | barley-grain | 375 | 144 | 313 | 120 |
| 07-07-10 | Control | 0.8 | straw | 188 | 19 | 313 | 31 |
| 07-07-10 | Control Total | | | | *(271)* **163** | | *(558)* **151** |

*Summary of yields in kg/ha, expenses (between brackets) and income for the two years. Monetary unit is Turkish Lyra. Note that there is an initial expense to create the levees of 2170 TL.*

## HOW WELL DOES IT WORK?

The results are evaluated from a production, socio-cultural and economic point of view. The bars express the estimated or measured percentage of change with respect to the reference situation. This change can be positive (blue) or negative (red). Note that this evaluation is based on the experiments, on the long term experience of the coordinating team in this area and on consultations with the farmers.

NOTE: the evaluation outcome was nearly the same for both technologies. The only difference is that for contour ploughing alone the negative judgment of farm operations is less severe. Creating and maintaining the levees is considerable more effort than the tradional tillage.




## STAKEHOLDER'S OPINIONS

The stakeholders meeting showed the importance of bringing solutions to this degradation trend which threats both the environment and the farmers' income. The farmers experience shows that barley is the most appropriate crop for the terrace and the contour ploughing technologies. Stakeholders were passively involved in the construction of wooden terraces as observer. In the last harvesting season, stakeholders visited mutually the implementation area and discussed the

technologies. By using their own experiences they found that barley crop in terraced and contour ploughed spots are more robust compared to control parcel. Stakeholders mostly think that due to low rainfall rates throughout the growing season 2009 and lack of fallow in our application radically decreased the effectiveness of the technologies applied. In a wider sense they believe that the population is becoming older due to intense migration of young people to big cities for economic reasons, which puts an extra stress on implementing technologies at a larger scale.

Terracing involves additional costs and possibly loss of some land whereas contour ploughing can be widely applied without much effort. Also it is seen as a slight loss of land. The field however has to be wide enough because contour ploughing might create many short tracks and turns of a tractor, which causes a yield loss. Generally it needs only cost for fuel use which is similar to traditional ploughing. However some training is needed for implementing in steeper slopes. Also smaller tractors with more manoeuvre capability will be better in cultivating terraced land.

## CONCLUSIONS

Contour ploughing and terracing seems to have a slight increase in top soil moisture due to reduced runoff but this depends on the seasonal rainfall. The technology helps in improving soil condition and crop growth as well as increased yield benefits. The yields over two years were much higher in the experiments than in the control plot, even while the rainfall was very different between the years.

Regarding relatively smaller costs involved in contour ploughing, the technology is applicable in wider hill slope areas of semi-arid Central Anatolia. The levees with fences were considered less advantageous because of initial costs and loss of agricultural area, for little gain.

Main bottleneck for the easy application of technologies seems sociological (lack of enough young farmers) and economic (prices etc.) rather than scientific.

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➜ This project has been funded by the European Commission DG Research-Environment Programme
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Head of Unit *Pierre Mathy*, Project officer *Maria Yeroyanni*