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Policy Brief

Recommendations from the Karapinar region of Turkey

Stubble Farming Increases Yield in Wheat Cropping in Central Anatolia

Desertification is a phenomenon that adversely affects both the ecosystem and mankind living in arid and semi-arid regions. It's suggested that many parts the world will be affected in a direct or indirect way by desertification. As a consequence, regional and global scale social, environmental, political and economic perturbations are to be expected.

Previous studies showed that Turkey, due to its climatic setting and its socio-economic and geological structure, is a country that has been affected by intense desertification and this would worsen in the coming years due to global warming[1,2]. The most widespread desertification problem of our country, particularly in Central Anatolia, is drought, and related wind erosion and overexploitation of groundwater. In the Konya Plain in Central Anatolia , agriculture completely relies on groundwater use. Although some management and technical measures have been taken, the groundwater level still continues to drop rapidly without allowing a sustainable agriculture in the region. Additionally, strong winds in certain periods coupled with weak vegetation cover and loose soil particles, cause erosion of fertile topsoil.

This brief discusses the options for local farmers of using different technologies in order to reduce wind erosion in the area of Karapinar, on the Konya Plain. On the basis of 2 year monitoring, recommendations for decision-makers and land use planners are made.

A view from strip farming

Context and importance of the study

In a European Union supported project called Desertification Mitigation and Remediation of Land (DESIRE), Eskişehir Osmangazi University in collaboration with Selçuk University and some other institutions have been working on soil erosion by wind and excess groundwater use in a 110 km2 hotspot area to the south of Karapınar town, Konya province, for 5 years. For this purpose, selected farmers from the hotspot villages, accompanied by experts and academics with different backgrounds, have studied the desertification problems, looking at physical, social, educational, economic and agricultural aspects.

In the early meetings, the farmers determined the excessive groundwater use and related wind erosion as the most serious problems in the irrigated croplands. Previous agricultural research and expert knowledge indicated the same issues. In later meetings all stakeholders (including farmers, state experts and managers) discussed in detail the drivers and potential solutions of these problems. In addition the stakeholders presume the groundwater levels will drop even more rapidly due to expected global warming. They also think certain croplands will be abandoned due to increased costs and as a result of that wind erosion will become an even more serious threat in the near future. Discussions clearly indicated that the farmers would suffer the consequences of desertification in the medium and long term as they don't have the economic means to take effective measures. Consequently, understanding the applicability of certain soil and water preservation measures with sufficiently appealing economic advantageous becomes important.

Stakeholders discussing during the workshops

Options for yield increase

In the DESIRE project the stakeholders selected, by means of various criteria (DESIRE WOCAT methodology) some soil and water conservation measures that have been successfully applied in other parts of world. Among others, three technologies were considered promising due to easy applicability and low costs. These are:

1. Minimum tillage-fallow with stubble farming;
2. Plough tillage-fallow with stubble farming;
3. Plough tillage-fallow without stubble farming.

These technologies have been monitored for bread wheat (Triticum aestivum Var. Ekiz) experiments at Apak Yayla to the south of Karapınar with respect to crop yield, crop yield components and some soil properties for 2 years.

Dry wheat cropping in Central Anatolia

Results

According to the results of trials, number of sprouting plants is more in minimum tillage-fallow with stubble, but branching number is higher in plough tillage-fallow without stubble farming (see Table below). This is may be because the rotatil blade (a surfacial ploughing instrument) used in minimum tillage is not suitable to prepare an optimum seed-bed. On the other hand plough tillage-fallow with stubble farming produced higher grain yield and yield components (plant height, ear number in m2, number of grains in ear, weight of 1000 grains and harvest index) followed by plough tillage-fallow without stubble farming. Unexpectedly, minimum tillage-fallow with stubble system did not produce high yields. This can be explained by less topsoil erosion, organic matter and water availability in the fallow with stubble. In addition, an optimum seed-bed for rapid germination and healthy growth cannot be prepared by minimum tillage.

	Sprouting plant/m^2	Branching number	Plant height (cm)	Number of ears in m^2	Number of grains in ear	1000 grain weight (g)	Harvest index (%)	Grain yield (kg/ha)
Plough tillage-fallow without stubble	347	2.86	73.9	405	25.9	38.8	33.83	475
Plough tillage-fallow with stubble	350	2.57	76.8	531	26.3	40.2	35.05	551
Minimum tillage-fallow with stubble	362	2.07	70.6	396	23.7	36.9	32.82	369

Table: Effects of different tillage and fallow methods in wheat crop with strip farming on the yield and yield components (average of 2010 and 2011 years)

The soil analysis results also indicated that fallow parcels of land have higher pH, organic matter, phosphorus, and lower nitrogen. This indicates that the tillage decreases organic matter and causes more oxygenation of the soil profile, and the fertilizers, humic acid and sulfur decreases the pH of the soil. Additionally, nitrogen and phosphorous fertilizers accumulate in the soil, but in the cropped parcels of land they are used up by plants. Organic matter also decreases there too.. The plough operations increase the oxidation of organic matter by exposing it to air. For this reason, tillage operations should be reduced to prevent organic matter and moisture loss.

Conclusions and Recommendations

Wind erosion

As a conclusion, plough tillage-fallow with stubble method in strip farming is the technology that causes significant increases in yield of more than 16% compared to the other technologies (Plough tillage-fallow without stubble can be considered the reference technology which is used in non-irrigated areas in the region). However, the basic obstacles to adoption of the stubble farming technology are difficulties in tillage operations due to fallowed strips and decrease in farm income due to each fallowing year, as non-crop area causes a deficit.

For wider adoptions and application of this successful technology, therefore, the farmers should ideally be reasonably subsidized by the state for their fallowed strips. Additionally news of the positive effects of the technology upon crop yield and soil quality should be disseminated in systematic training courses by experts from universities and institutions to farmers.

References

[1] DPT, 2000. Report from the Climate Change Specialised Commission, 116 s.
[2] Türkeş, M., 2002. Climate change: Turkey-Climate Change Framework Relationship and Climate Change Policies, Vizyon 2023.

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