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Full Length Research

Organic matter and nutrient losses via run-off (March/December, 2016) in Urban Agriculture of Kabul, Afghanistan

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Kabul, bowl like capital city of Afghanistan is located at elevation of 18, 00 m a s l. with the current population of 4.2 million. The constructed areas have been encircled by urban fields. Climate is highly continental; rainfall always contributes water as a supplemental irrigation to agricultural crops. Sedimentations in streams, water courses, and in Kabul River are often observed. Urban fields have been regularly used for fresh vegetables and cereals in the rotation for food and feed production. Agriculture productions rely on fertilizers, but use of night soil and city bio-wastes are in abundance. Torrential rainfall is often observed as a main source of soil erosion. The run-off degrades environment by contamination of surface water, underground water, Kabul River and other low laying water bodies. A study on "Organic matter and nutrient (NPKC) losses via run-off in the Urban Agriculture (UA) of Kabul", was conducted (March-December, 2016) to quantify soil and nutrient losses via run-off in urban areas of Kabul. Four endemic crops of Kabul Province were planted in the rotation. The results showed neglect erosion according to the universal soil loss equation. The total Monthly average soil losses in two farms (n= 30) were 2.52 kg ha^{-1}. Maize and wheat plots had higher soil losses (19.30 and 18.52%), respectively. Barley and millet had lesser soil losses (15.37, and 12. 49%), respectively. Control plots of both farms showed 17.65% soil losses. The average total N, P, K losses were neglected due to low rainfall and short period of study, statistically the variation of soil losses under different cropping system was not significant (p >0.05).

Lastly, based on our findings, few recommendations have been suggested to scientists, farmers and policy makers.

Keywords: Run-off, Soil erosion, Kabul urban area, Afghanistan**.**

INTRODUCTION

Kabul is one of the largest city and the national capital of Afghanistan, located in a narrow valley along the Kabul River, overlooked by the Asmai and Sherdawaza mountain ranges, in the east-central part of the country. Kabul is an old city with a history of more than 3000 years. The city was for centuries a way-station and a major trading center at the trade routes between South and Central Asia (see figure 1). Kabul, one of the highest capitals in Asia, with its current population of 4.2 million (CSO. 2014/2015) is located at 18.00 m a s l. Kabul's soil has developed under arid and semiarid climatic condition. Unplanned use of city bio-wastes and sewage water for irrigation remained always main sources of

nutrients imbalance in the urban soil (Safi et al., 2010). The elemental overloaded sewage waters increases the materials toxicities in the soil during irrigation which degrades the environment. Despite of economic losses, leaching of nitrite, nitrate, phosphate, and ammonium contaminate surface and underground water. It is reported that Kabul basin is indicating deposits including sand, silt and clay which have been imported from the surrounded mountains originated by carbonates, marls, sand stones and from melted magma karsts. Ground water in some places of Kabul city is affected by sedimentation which contained toxic materials such as NO_2, NO_3, Bo_2 and other soluble contaminants (Initial Environmental Examination., 2011; Mohummad et al., 2014). The 10.8% contaminated wells of Kabul with nitrate can be good example (Houben. 2005). Leaching of nitrate, phosphate and ammonium in the vegetable production areas were reported high too (Safi et al., 2011). Contamination of Kabul River in the low laying area of Peshawar with some toxic elements was also reported. (IUCN, Pollution and the Kabul River, 1994). This can be solved by study of the current ongoing farming system and applying different practices such as soil and crop management, soil erosion control will increases soil productivity. Chaudary and Shafiq reported that crop management is one of the best ways of soil erosion control (Chaudhry and Shafiq, 1986). The practice of good cultivation combination, optimum sowing method, use of mulching; disclose crop cultivation and precise use of chemical and organic fertilizers may enhance soil protection.(Safi, et. al. 2016; Khan, et. al. 2007).

Figure 1: Map of Kabul

Source: Google 2017

Lacking of researches, experts and other professional staff in the country or missing proper developmental budget of the government for research has made soil preservation in the country especially in urban area of Kabul impossible, so far. Based on the following highlighted problems we have studied organic matter and nutrient removal via surface run-off to the streams, rivers, ponds and water bodies and its consequences in the future urban dwellers' life.
− The applied city bio-wastes, and sewage sediments are vulnerable to the erosion and are easily removable by

run-off water. The transportation of such materials to the water courses, streams and canals may cause pollution and degrading the environment. The polluted environmental negative effects are obvious in the health of inhabitants. (Safi, M.A. 1998).

− In the cereal areas, the cropping system is mostly mono cropping. After crops are harvest, the field is left unplowed and is intensively grazed by local animals. The crop residues used by animal or being collected by local people for heat generation in their kitchens. The exposed soil surface remains very sensitive to the wind and water erosion. The subsequent sedimentation in the irrigation systems and even in electric generating dam cause huge economic losses to the investments. Filling of Naghlo, Daronta and Sarobi dams can be the best examples in the country.

− Cereal areas of Kabul in contrast to the field of vegetables and vineyards are highly erosive. This indicates that organic and inorganic surface materials are highly transportable in this system. Despite of soil removals there is possibility of creating rills and gullies in the surface of the land which may create constraints for irrigation and operating farm machineries.

− In addition mono cropping is enhancing the soil erosion followed by impediment for furrowing and irrigation of the field. Lacking data on nutrient losses via torrential rainfall in the urban area

− of Kabul made it difficult to plan cultivation with reduced erosion. Our study will explore the amount of organic matter (Corg) and crop nutrients leaving the fields via run-off.

Objectives of the Study

The major objectives of the study were:

1. Measurements of the soil and organic matter removed by run-off.
2. Measurements of crops nutrients (N, P, K, C) in the sediments.
3. Identifying the factors that influence soil and nutrient losses by run-off.
4. Explaining how run-off, soil and nutrient loss are related.
5. Comparison of the nutrient lost by run-off versus nutrient obtained by production.

The ultimate aim of this research is to control economic losses of the farmers', protect humans' health and control environmental degradation.

MATERIALS AND METHODS

Geographic location of the area and site selection

Greater Kabul is located in a valley, bordered by high mountain ranges. The average annual precipitation of 300-330 mm occurs mainly from November to May and the surrounding natural semi-desert steppe vegetation provides vast grazing grounds for small and large ruminants during three summer months. Average annual temperature varies between 10°C to 13°C with a relative humidity of 54 %)Grieser et al., 2006; Houben and Tunnermeier 2005), (1957-1977). During the latest study of the author (April 2008-March 2010) the climatic conditions were with an average annual rainfall of 176 mm and 346 mm, a relative humidity of 45.3% and, an average temperature of 14.8°C drier and hotter than normal. (Safi et al. 2011). In our recent study period the average monthly rainfall was 18.52 mm.

In the study area rain-fed wheat (*Triticum aestivum* L.) is grown on 6% of the cultivated land and harvested between July and August, while irrigated wheat, potato (*Solanum tuberosum* L.) and fresh vegetables occupying 94% of the land were harvested between May and October. Irrigation systems are fed by diverted rivers and the traditional underground 'Karez' channel systems. Average cultivated land of a farm household is 0.2 ha, but a few large households had irrigated farms >1 ha. The livestock sector in the Kabul region is dominated by cattle (including dairy cows) and sheep, but also comprises goats, donkeys, horses and poultry.

− Basic socio-economic data on Kabul's UA systems were reported by Safi which indicated that the vegetable farming system in the highly populated areas along the Kabul River (34°29' 59.76" N, 69°09'22.06" E; 1,765 m a.s.l.) where plot sizes range from 54 -1,000 m^2 and the most important species are radish (*Raphanus sativus* L), coriander, (*Coriandrum sativum* L), leek (*Allium ampeloprasum* var. *porrum* L), onion (*Allium cepa* L), carrot (*Daucus carota* L.), turnip (*Brassica compestris* var. *rapa* L.), eggplant (*Solanum melongena* L.), spinach (*Spinacia oleracea* L.), pepper

(*Capsicum annuum* L.), lettuce (*Lactuca sativa* L.), mint (*Mentha arvensis* L.), garlic (*Allium sativum* L.), cabbage (*Brassica oleracea* L.), pumpkin (*Cucurbita moschata* L.), tomato (*Lycopersicon esculentum* L.), and forages. Farm work, product sales, and input acquisition keep farmers busy throughout the year.

- The cereal production area (34°28'45.96"N, 69°12'54.94"E; 1,767 m a. s. l.) is in the southern part of the city. It obtains its irrigation water from the Char Asyab district in the spring season, but during summer the amount of available water is insufficient for irrigation. This area has no proper drainage and in spring occasional rainfall events may lead to flash floods that rush through the low laying areas. At plot sizes of 100 - 2,000 m^2 the local cropping system is dominated by wheat, followed by potato, onion, turnip, corn (*Zea mays* L.), and forages. This system is largely subsistence-oriented whereby open land is used by pastoralists who's animals are freely grazing in the city surroundings.
- The vineyards for raisin grape production (34°34'12.27"N, 69°14'13.15"E; 1,758 m a.s. l.) with plot sizes of 200-6,497 m^2 have a well established irrigation infrastructure. For these access to the city's solid organic waste inputs is hampered by Kabul's international airport separating this area from the city center. In the spring, irrigation water for this area comes from Kabul River and during the remainder of the year from sewage water of residential areas complemented by sewage sludge compost.

Layout of the experiment

- Design RCBD, 5 treatments were replicated 3 times.
- Plot size: 1.5*2 = 3 m2.
- Treatments: Wheat, Maize, Barley, Millet and Control.
- Slope; Average slope 0.5 – 1% (Sharma**,** 2007).
- Plot to plot distance: 0.3 m.
- Distance between replications was 0.50 m.

All plots were marked prior to the cultivation. Polyethylene plastic buckets and siphons were installed properly in each plot and were covered with plastic sheet.

Measurements of sedimentations

Subsequent to the rainfall, the sedimentations (figure 1) have been collected and transferred to the laboratory; conical flask and filter paper were used for filtration of the sediments. The filtered material dried in room temperature. Subsequently the dried soil samples of each plot (treatment) were stored in polyethylene bottles and sealed until analysis of N, P, K and C.

Figure 1: Treatments and view of installed plastic bucket for collection of sediments

Statistical analyses

Analyses of Variance (ANOVA) and Univariate Analyses of Variances (UANOVA) were performed using SPSS (Version 18.0, SPSS Inc., Chicago, IL, USA) to determine the significance of differences between the different treatments for soil and nutrient.

EXPERIMENT

AL RESULT

Precipitation

The projected ten month data of six meteorological stations (table 1) revealed that total amount of rainfall had not optimum amount, distribution and intensity throughout the ten month of 2016 which declined the possibility of soil erosion. Which was rainfall occurred in March, May was considerable, but May had finer amount and distributions. Precipitations on June, July, August, September, October, November and December with its lower, amount, intensities and distribution caused neglected erosion. As a whole, in this period, Monthly average amount of rainfall was smaller (18.5 mm).

Despite of the lesser amount of rainfall, intensity and distribution, in the research period there were few factors which influenced run-off and soil erosion such as: soil properties, soil structures, soil water holding capacity and field slopes.

Table 1: Total monthly rainfall from five metrological stations of Kabul Province

Station Name	Parameter	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Badam Bagh	Rain_mm	**45**	**0**	**125.8**	**14.5**	**17.3**	**12**	**4.5**	**1.5**	**0**	**0**	**3.5**	**0**
Darulaman	Rain_mm	**36.9**	**1.4**	**90.4**	**28.4**	**22.5**	**6.5**	**0**	**0**	**0**	**0**	**2**	**0**
Gul Khana	Rain_mm	**38**	**1.5**	**106.5**	**12.5**	**26**	**10**	**2**	**3.2**	**0**	**0**	**3.8**	**0**
Paghman	Rain_mm	**74**	**4**	**212**	**12**	**65**	**8**	**0**	**5**	**0**	**0**	**3**	**2**
Sarobi	Rain_mm	**16.5**	**3**	**51**	**2**	**19**	**1**	**2.5**	**2.3**	**27**	**17**	**1.5**	**3**
Total	month^{-1}	**42.08**	**1.98**	**117.14**	**13.88**	**29.96**	**7.5**	**1.8**	**2.4**	**5.4**	**3.4**	**2.76**	**1**

Ministry of Agriculture, Livestock and Irrigation (MAIL) Department of Statistic's unpublished data.

Table 2: Monthly average soil losses (n=30) via run-off (March-December, 2016) in the College of Agriculture and Guzarghah research Stations.

Research Station	Mean (kg ha^{-1})	Std.	N
Agriculture Collage Sta.	2.55	2.29	15
Guzargah Research Sta.	2.49	.856	15
Total	2.52	1.70	30

P > 0.05

Average Monthly soil losses from two farms (Collage Farm (n=15) and Guzargah Research Station (n=15) via surface run-off (March – December 2016).

The total soil losses in the two farms were 5.04 kg ha^{-1} where College farm (n= 15) lost 50.57 % (table 2) of surface during rainfall and Guzargah Research station (n= 15) lost 49.43 % of soil in sedimentation.

However, the two farms had identical climatic conditions.

Average monthly Soil losses (n=30) via run-off (March – December, 2016) from different plots in the College of Agriculture and Guzarghah Research Stations.

The data Analysis revealed interesting results, that using different cereal crops in the rotation had significant effect on erosion control of two sites. The soil losses data (table 3) revealed that total Average monthly soil losses from all plots were 2.52 Kg ha^{-1}, college farm had

Table 3: Monthly soil losses from different crop fields via surface run-off on (March-December, 2016) in College of Agriculture and Guzarghah research Stations.

Crop	Mean (kg ha^{-1})	Std.	N
Barley	2.32	1.24	6
Control	2.67	2.31	6
Maiz	2.92	2.72	6
Millet	1.89	.85	6
Wheat	2.80	.98	6
Total	2.52	1.70	30

P >0.05

Table 4. Post Hock Test, Comparison of soil losses of each plot with the plot of different crop of the experiment. Kg Soil ha^{-1}
LSD

(I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Barley	Control	-.35	1.03	.74	-2.47	1.78
	Maiz	-.59	1.03	.57	-2.72	1.53
	Millet	.44	1.03	.68	-1.69	2.56
	Wheat	-.48	1.03	.65	-2.60	1.65
Control	Barley	.35	1.03	.74	-1.78	2.47
	Maiz	-.25	1.03	.81	-2.37	1.87
	Millet	.78	1.03	.46	-1.34	2.90
	Wheat	-.13	1.03	.90	-2.25	1.99
Maize	Barley	.59	1.03	.57	-1.53	2.72
	Control	.25	1.03	.81	-1.87	2.37
	Millet	1.02	1.03	.33	-1.09	3.15
	Wheat	.117	1.03	.91	-2.01	2.24
Millet	Barley	-.44	1.03	.68	-2.56	1.69
	Control	-.78	1.03	.46	-2.90	1.34
	Maiz	-1.02	1.03	.33	-3.15	1.09
	Wheat	-.91	1.03	.39	-3.04	1.21
Wheat	Barley	.48	1.03	.65	-1.65	2.60
	Control	.13	1.03	.90	-1.99	2.25
	Maiz	-.11	1.03	.91	-2.24	2.01
	Millet	.91	1.03	.39	-1.21	3.04

Based on observed means. The error term is Mean Square (Error) = 3.189.

maximum losses (50.57 %) as compared to the Guzargah farm (49.43%). Maize plot revealed maximum erosion (18.52%) followed by wheat (17.65 %). However, Millet (12.49%) and Barley (15.37 %) showed minimum soil losses. Statistically the variation was not significant ($p > 0.05$)
Due to lesser amount of the sediment or eroded soil the
N. P. K and C were not measured in Table 4.

DISCUSSION

The total average ten month data of five meteorological stations (March-December, 2016) indicated that urban areas of Kabul received rainfall with abnormal distribution, intensity and amount. As a whole the amount of rainfall in March, April and May were considerable but the subsequent months had lesser precipitation. This caused decreased soil erosion. While, it is obvious that annual rainfall with abnormal distribution and more intensity may generate surface run-off.

Possible reason should be flat surface of the land with slope of (0.5 – 1) which was confirmed by Romkens (Romkens, et al., 2001), who reported that level lands, smooth surfaces, short running surface for water, decreases soil erosion. Furthermore, it was also confirmed by Ziadat and Taimeh (Ziadat and Taimeh., 2013). Ziadat reported that rainfall intensity increase soil erosion. Fields covered with vegetation especially, prior to the rainfall season decrease soil erosion, the results were also confirmed by some other articles (Defra, 2005; Ali et al., 2007).

Total monthly average soil losses (n=30) in the College of Agriculture and Guzargah Research Stations.

The total soil losses (n=30) in both farms (March- December, 2016) were calculated (2.52 kg ha^{-1}) under different cropping systems. Collage farm had higher soil losses (50.57%) as compared to the Guzargah Farm (49.43 %). Average monthly soil losses in Maize (19.30 %) plot was higher followed by wheat (18.52 %) and control plot (17.65%).

Possible reason for the variation of soil erosion in different treatments could be the soil properties, soil structure and soil water holding capacity. The second factor could be surface soil status; Michael reported that amount and status of the soil surface in the field should not be ignored (Michael, et. al., 1999). In this regards Limon, Neun and Micle pointed out that leaving more crop residues in the surface of soil, minimum tillage, should have its role in the control of soil erosion (Lemunyon, no date).

The third factor should be status of the seasonal rainfall which happens in different frequencies, amount, intensity, duration and time. The variations of the seasonal rainfall especially, in the arid and semi arid zones have been confirmed by Feng (Feng et. al., 2013). Furthermore, the existence of crop residues or crop growth stages may affect soil erosion rate. Slop is another erosion controlling factor which was moderate in these two farms. Wind breaker also affects soil erosion by decreasing the intensity and velocity of the raindrops on the soil surface. It would be better to search for further factors which may decrease the soil erosion and eliminate the concerns and problems. These results may have some problems. The unpublished data adopted from Mail's stations, also revealed problems. To increase the viability and credibility of the data the number of metrological station should be increased.

These results have explored that growing of cereals especially, winter wheat, barley and millet in the rotation had beneficial role by protecting soil erosion. And losses of crop essential nutrient via night soil, organic matter, commercial fertilizer and so on.

The result has been confirmed by Zachar (Zachar, D. 2011). Basically this issue was arisen in the workshop of R. C. S. (Kasper, et al. 2008) under the title of (utilization of cereal as cover crops for environmental protection). In this workshop several scientist such as thomkasper, Germy, Sangar, beennoston had participated and confirmed the content. Manor also recommended that barley, and wheat should be grown for soil erosion control and other benefits (Rasnake, et al. no date). The results of soil erosion control by plantation of cereals are also in line with the recommendation of G V Menreng sing (Mannering et al., no date). Our results regarding the increased losses in maize plot of the research has

been confirmed by Ailincai (Ailincai et al., 2011). He had argued that decreased losses in control plot may be related to the time of rainfall but some of the scientists discovered that cover crops always protect soil from erosion. This idea was highly contradicted with ideas which said that soil erosion is less in the fallow fields (Nabi et al., 2008'; Atucha, et al., 2012).

CONCLUSION AND RECOMMENDATIONS

Based on the universal soil loss equation soil erosion via surface run-off in two farms of Kabul under different cropping system were neglected. In such circumstances soil erosions in the urban area of Kabul may not be risk for agricultural lands. In addition to moderate slop and little rainfall, the land status and precipitations time also affect soil losses. The most important corps which had good contributions to the control of soil erosion in the duration of ten month was millet and barley. Maize and wheat had less effect on soil erosion control. Finally to control soil losses it is necessary to consider the followings:

- Decomposed organic fertilizers, and city bio-wastes should be applied in a proper time.
- Chemical fertilizer should be applied in proper time and doses, and the application should split in different crop growth stages
- Slope of the land should be ranged about 0.1 to 2 % and despite of legumes crops cereal crops should be planted in the rotation
- Fields should be kept leveled, undulation of the surface must be avoided and Agro-pastoral live stocking should be balanced

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REFERENCES

Ailincai, C., Jitareanu, G., Bucur, D., Ailincai ., D. (2011). Water Run-off and Soil Erosion, Registered in Different Crops, on 16 % slope lands. Agricultural Research and Development Station, University of Agricultural Sciences and veterinary Medicine, Podu-lioaiei, Lasi County, Romania.

Ali, I., Khan, F., Bhatti, A.U. (2007). Soil and Water Nutrients Losses by Water Erosion Under Mono- cropping and Legume Inter-Cropping on Sloping Land. Journal of Agriculture Research, Pakistan, V (20), 3-4.

Atucha, A., Merwin, I.A., Michael, G., Gardiazabl, F., Mena, F., Adriazola, C., Lehmann, J. (2012). Soil erosion, run-off and nutrient losses in an avocado hillside orchard under differ ground cover management systems. Journal of Plant Science, DOI: 11104-1520-0.

CSO (2014/2015): Statistical Indicators in Kabul Province (2014 -2015). Islamic Republic of Afghanistan. http://www.cso.gov.af/ (accessed 2th December, 2015).

Chaudhry, M.A., Shafiq, M. (1986). Effect of crop management on soil and water conservation. Journal of Agricultural Research, 24: 17-25.

Defra (Department for Environment Food and Rural Affairs). Revised (2005). Amanual for the assessement and management of agricultural land at risk of water erosion in lowland England. Available online at: (http://archive.derfa.gov.uk/envir onment/quality/land/soil/docu ments/soileros ion- lowlandmanual.pdf).

Feng, X., Porporato, A., Rodriguez-Iturbe, I. (2013). Changes in rainfall seasonality in the tropics. Nature Climate change 3, 811-815, DOI: 10. 1038 availabel online at: (http://www.nature.com/nclimate/journal/v3/n9/full/n climate1907.html#access).

Grieser, J., Gommes*, R., Cofield, S.* (2006): On the estimation of monthly precipitation fields in Afghanistan. The Agromet Group, SDRN. Food and Agriculture Organization of the UN (FAO), Viale delle Terme di Caracalla I-00100 Rome, Italy.

Houben, G., Tunnermeier, T. (2005): Hydrogeology of the Kabul Basin, Part I: Geology, aquifer characteristics, climate and hydrography. Foreign Office of the Federal Republic of Germany, AA-Gz' GF07 885.28/3 16/3. BGR record no: 10277/05. Initial Environmental Examination (IEE). (2011). Environmental Assessment and Report. Islamic Republic of Afghanistan, Transport Network Development Investment Program (RRP AFG 44482-02).

IUCN the World Conservation Union. (1994). Pollution in the Kabul River, An analysis and Action Plan. The Pakistan program, IUCN-SPCS Unit. Planing, Environment and development Department, Civil secretariat, Peshawar.

Kasper, T., Sinber, J., Knustson, B., Kohler, K., Heikens, K., Jaynes, D., Parkin, T., Moorman,T. (2008). Central Service Area-Plant and Soil Science workshop. Ames, IA-NRCS.

Available online at:http://www.mccc.msu.edu/documents/Protectingt he-SoilEnviro nmentUsing SmallGrain CoverCrops5-21-08TKaspar.pdf.

Khan, F., Waliullah, M., Nadeem., Bhatti, A. U. (2007). Effect of slope steepness and wheat crop on soil, Run-off and Nutrient Losses in eroded and land of Malakand Agency, NWFP, Pakistan. Sarhad Journal of Agriculture, 23 (1),

Lemunyon, J. (2015). Conservation Tillage and Crop Residue Management. USDA-NRCS, Fort Worth, Texas. Available online at: (http://www.sera17.ext.vt.edu/Document- s/BMP_tillage.pdf.

Michael, J., Tidman., Gerald, M. (1999). Use crop residues for soil conservation. Integrated Crop Management, IC, 482: 8 availabel online at: (http://www.ipm.iastate.edu/ipm/icm/1999/5-3-1999/useresidues.html.

Mohammadzade, Z,. Bazrgar, A. B. (2014). Assessment of sustainability indicies in , Barley and Wheat base on Nitrogen dynamics in Neyshapur. Indian Journal of Fundamental and Applied Life Sciences, ISSN: 2231 – 6345. Online: online international Journal, Available at http://www. Cibtech.org/jls.htm 4-(4).

Ministry of Agriculture and Food. (2000). Estimating crop residue cover for soil erosion control. Soil fact sheet, British Columbia. Available online at: (http://www.agf.gov.bc.ca/resmgmt/publist/600Series/64 1220-1.pdf)

Nabi, G., Latif, M., Ahsan, M., Anwar, S. (2008). Soil erosion estimation of Soan River catchement using remote sensing and geographic information system. Soil and Environment 27 (1): 36-42

Rasnake, M., Dunwell, W., Weston, L. no date. Winter Cover Crops for Kentucky Gardens and Fields. Univeristy of Kentuck, College of Agriculture. Cooperative Extension Services, Lexington, KY, 40546. Available online at: (http://www2.ca.uky.edu/agc/pubs/id/id113/id113.pd f

Romkens, M.J.M., Helming, K., Prasad, S. N. (2001). Soil erosion under different rainfall intensities, surface roughness, and soil water regimes. USDA-ARS National Sedimentation Laboratory. Elsevier, Catena 46: 103-123.

Safi, Z., Bahram, G.M. and Alemi. M. A.2016. Organic matter and nutrient (NPKC) losses via surface run- off in Urban Agriculture (UA) of Kabul, Afghanistan International Journal of Agricultural Research and Review: ISSN-2360-7971, Vol. 4(1): pp 440-447.

Safi, Z. and Buerkert, A. 2011. Heavy metal and microbial loads in sewage irrigated vegetables of Kabul, Afghanistan. Journal of Agricultural Research in the Tropics and Subtropics 112(1), 29-36.

Safi, Z., Predotova, M., Schlecht, E. and Buerkert, A. 2011. Horizontal matter fluxes and leaching losses in urban agriculture of Kabul, Afghanistan. Journal of Plant Nutrition and Soil Science 174(6), 942-951.

Sharma, P. (2007). Applied Soil Ecology. Gen-Tech Books. 4762-63/23, Ansari Road, Darya Ganj, New Delhi-110 002. ISBN: 978-81-89729-25-7. PP. 32.

Safi, M.A. (1998). An integrated approach to sanitation and health in Kabul. Sanitation and water for All, 24th WEDC Conference, Isalm Abad, Pakistan. Tiwari, K.R., Sitaula, B.K., Bajracharya, R.M., Borresen, T. (2009). Effect of soil crop management practices on yields, income and nutrients losses from upland farming systems in the Middle

Mountains region of Nepal. Nutrient cycling and agroecosystem research, DOI: 10:1007/s10705-9289-0.

www.nationsonline.org/oneworld/map/google_map_Kabul.htm. Accessed 20th September, 2016

Ziadat, F.M., and Taime, A.Y. (2013). Effect of Rainfall intensity, slope, land use and antecedent soil moisture on soil erosion in an arid environment. Land Degradation and Developemnt. DOI: 10-1002/ldr.2239.

Zachar, D. (2011). Soil erosion, Development in soil science 10, Veda, Publishing House of the Slovak Academy of Sciences, Bratislava. P – 304.