Annual Report
2015-2016

SOIL & WATER CONSERVATION RESEARCH INSTITUTE, CHAKWAL PAKISTAN

Introduction

EROSION and moisture stress are two main problems that farmers of Barani area face. Conservation agriculture can help overcome both by conserving soil and storing water in the soil. If erosion and water dependence are severe, combination of conservation agriculture with other techniques to control erosion and water scarcity are most suitable solutions to overcome the problems. In drier areas rain water-harvesting methods are most appropriate to make more water available to the crop.

To overcome the problems of erosion and water in rainfed areas, **"Soil and Water Conservation Research Institute Chakwal"** (SAWCRI) was established in 1989 that has standardized advance technologies for soil and water conservation keeping in view the specific Agro-climatic zones (High rainfall, Low rain fall) of rainfed areas after extensive research.

In Barani area water shortage is further accentuated with uncertain behavior of rainfall. Sustainable use of these precious resources is imperative to socially, economically and ecologically viable communities. Its research stations at Sohawa, District Jhelum and Fatehjang, District Attock to address the issues and problem soil and water directly. The targeted area of SAWCRI research is efficient utilization of available moisture for sustainable agriculture. Soil and water conservation research institute (SAWCRI) is also focusing on the onfarm composting aimed to maintain the soil health and fertility as well as the improvement of the livelihood of farming community through the international projects funded by ICARDA, USDA, USAID and UNESCO.

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SAWCRI CHAKWAL

SAWCRS FATEH JANG

SAWCRS SOHWA

THEME # 01

SOIL AND WATER LOSS MONITORING

EXPERIMENT # 1.1	
TITLE	**IMPACT ASSESMENT OF SOIL & WATER CONSERVATION INTEVENTIONS ON SEDIMENT YIELD AT CATCHMENT SCALE.**
OBJECTIVE	To measure sediment yield at the outlets of selected small catchments after development of soil & water conservation interventions in Dharabi watershed, Chakwal
RESEARCH WORKERS	1. Mr. Bashir Hussain 2. Dr.Riffat Bibi 3. Mr. M.R. Sajjad
DURATION	2014-2019
LOCATION	Dharabi watershed area near villages Thoa Bahadar and Rahna Sadaat, District Chakwal
METHODOLOGY	Two land use systems will be investigated in Dharabi watershed including : 1. Gully catchment 2. Terraced field catchment Catchments are already selected and SAWCRI has been collecting soil water losses data since 2009 under natural conditions without interventions. Interventions may include: Runoff harvesting loose stone structures, micro-catchments, check daming, plantations etc. depending on site topography and farmers interest. After implementation of interventions, data on following parameters will be collected on seasonal basis using/maintaining existing stilling basins and weirs constructed at the downstream of each catchment.
PARAMETERS	• **Bed load: S**ediments deposited in stilling basin will be measured by draining the sediment basin and weighing the sediments on oven dry basis.

	• **Sediment analysis** Samples will be analyzed for O.M., particle size, Av P and Extractable K. • **Soil analysis: S**oil samples from catchments will be taken and analyzed for ECe, pH, OM, Texture, Av P and Extractable K. • vegetation/land use Rainfall
PREVIOUS YEAR'S RESULTS/ ACCOMPLISHMENTS	**First Year**

THEME # 02
SOIL CONSERVATION

EXPERIMENT # 3.1	
TITLE	**ASSESSMENT OF GULLY EROSION IN POTOHAR**
OBJECTIVE(S):	• To quantify the status of gully erosion in Potohar. • To study the temporal variation in gully dimension under different land use and soil.
RESEARCH WORKERS	Mr. Waqas Naseem Mr. Ghulam Muhammad
DURATION:	2015-2025
LOCATION:	Tehsil Chakwal, Kallar Kahar
METHODOLOGY	• Topographic survey of the area • Catchment area • No of gullies in catchment, gully density • Length, width & depth of gullies • Rain gauges will be installed to measure monthly rainfall • Soil texture, Infiltration rate, soil moisture, bulk density and sediment load
PREVIOUS YEAR'S RESULTS	New experiment

EXPERIMENT # 2.2	
	STUDY AND EVALUATION OF EROSION CONTROL STRUCTURE INSTALLED AT CHAKWAL
OBJECTIVE(S):	Measurement and Evaluation of soil deposition at different loose stone structures
RESEARCH WORKERS	1. Dr. Riffat Bibi 2. Shahid Munir
DURATION:	2015-2017
METHODOLOGY	**Treatments** C1= Unstructured field T1= Rhna Sadat C2 = Structured field T2= Khandoa C3 = broken structured field, T3= Kokhar balla T4= Chak khushi
PARAMETERS	Land use, Soil deposition, soil physical (texture, Infiltration rate, Rainfall, Organic matter, yield data
PREVIOUS YEAR'S RESULTS	**New experiment**

EXPERIMENT # 2.3	
TITLE	**EVALUATION OF MECHANICAL CHECKDAMS FOR SOIL CONSERVATION IN UNCULTIVATED GULLIED AREAS.**
OBJECTIVE	To assess gully bed development rate for gully farming in Un-cultivated gullied areas.
RESEARCH WORKERS	1. Mr. Bashir Hussain 2. Dr. Riffat Bibi

	3. Mr. M.R. Sajjad
DURATION	2014-2019
LOCATION	Bhatti gujjar watershed in District Chakwal
METHODOLOGY	One sub-watershed in village Bhatti gujjar has already been selected and initial survey done with development of few check dams under watershed rehabilitation project. In this study, the detailed topographic survey will be done with GIS/GPS support and remaining check dams will be developed based on survey to cover entire watershed. Boundary of sub-watershed will be marked using GPS and field survey. Permanent benchmarks will be established and after completion of check dams following data will be collected on seasonal basis at the upstream of each check dam: 1. Soil deposition 2. Land use 3. Soil fertility Rainfall data
PREVIOUS YEAR'S RESULTS	**First Year**

Theme # 3
WATER CONSERVATION

EXPERIMENT # 3.1	
TITLE	**Comparison of different tillage practices for moisture conservation and improvement of wheat yield**

OBJECTIVE(S):	• To compare the efficiency of different tillage implements for moisture conservation and improvement of wheat yield
RESEARCH WORKERS	1. Muhammad Rafique Sajjad 2. Ghulam Muhammad 3. Anwar ul haq Khalid
DURATION:	2015-2018
METHODOLOGY	T1 = Cultivator T2 = M.B. Plough T3 = Disc Plough • The implements will be used during Kharif • Wheat Crop will be sown during Rabi
PARAMETERS	• Soil pHs, ECe, O.M, Av. P, Ext. K, and texture at start of study • Soil O.M after crop harvest every year • Soil moisture (0-30, 30-60 and 60-90 cm) at sowing, 03 months after sowing and at harvesting of wheat crop • Wheat grain and straw yield • Plant population No. of fertile tillers
PREVIOUS YEAR'S RESULTS	New experiment

EXPERIMENT # 3.2	
TITLE	**Evaluating effects of micro-catchment rainwater harvesting techniques on irrigation frequency of fruit plants**
OBJECTIVES	• To optimize use of supplemental irrigation for fruit plants using water harvesting techniques. • To develop irrigation schedule for fruit plants in semi-arid region.
RESEARCH	1. Syed Zia ul Hasan

WORKERS	2. Dr. Riffat Bibi 3. Safia N. Malik
DURATION:	2015-2019
LOCATION	SAWCRI Research Farm, Tehsil Kalarkahar District Chakwal.
METHODOLOGY	Fruit plants: Olive Micro-catchment techniques 1 = Semi-circular 2 = Square-shaped 3 = V-shaped 4 = Control (no microcatchment) Irrigation systems: Drip system Bubbler system
PARAMETERS	Soil moisture monitoring through tensiometers. Plant height, Canopy area, fruit yield and quality Quantity of water applied. Criteria for supplemental irrigation: 50% depletion of available water (FAO I&D manual 56).
PREVIOUS YEAR'S RESULTS	New experiment

EXPERIMENT # 3.3

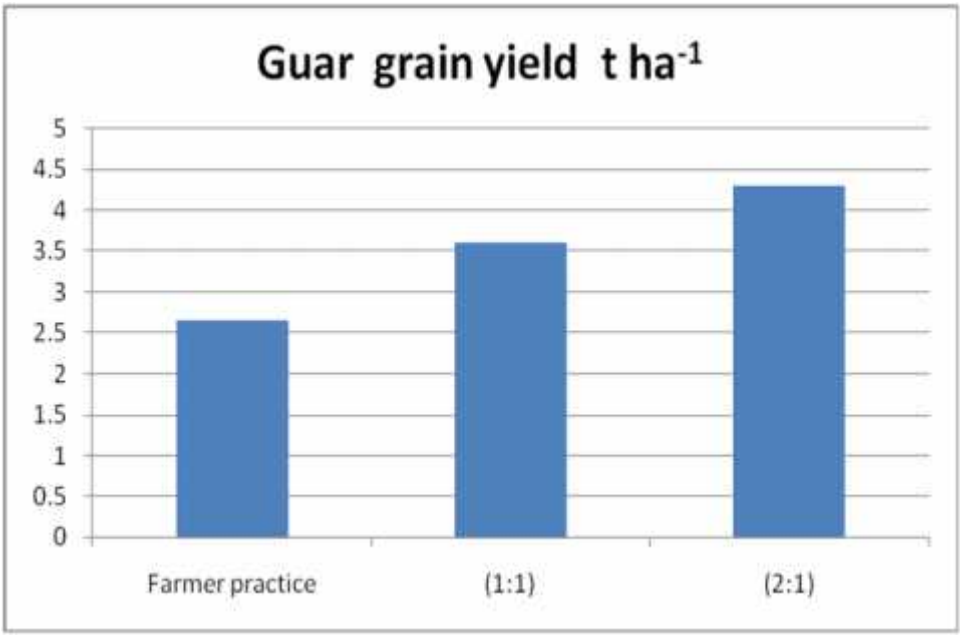
TITLE	**Water harvesting in dryland areas adopting micro-watershed approach of Strip Cropping for Crop productivity enhancement**
OBJECTIVES	To assess feasibility of strip cropping on soil water status &crop productivity in low rainfall areas.
RESEARCH	1. Mr. Ghulam Muhammad

WORKERS	2. Mr. Bashir Hussain 3. Mr. Riaz Hussain Khan
DURATION:	2014-2019
LOCATION	Farmers' fields in Tehsil Talagang & Lawa, District Chakwal.
METHODOLOGY	No. of site = One **Crops** under study: Guar (grain purpose) Sorghum and millet (fodder purpose) Catchment-cultivated area ratios: 1. 1:1 2. 2:1 3. Farmer's practice. No cultivation in catchment strips. Inputs application only in cultivated strips.
PARAMETERS	Basic soil analysis; Rainfall data at site. Profile moisture monitoring on monthly basis. Crop yield/biomass. Economic analysis

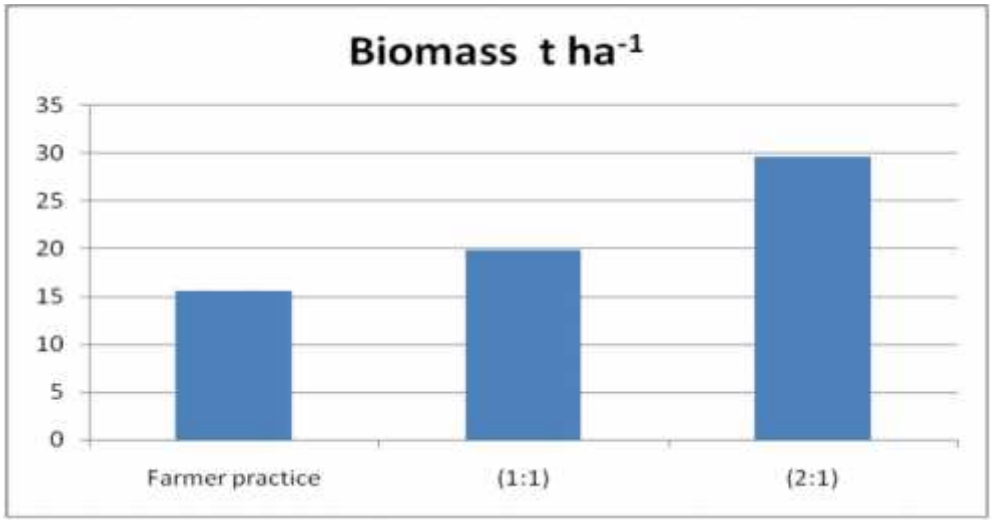
PREVIOUS YEAR RESULTS:

Basic soil analysis	
Soil Texture	Sandy loam
pH	7.8
ECe	0.41 dS m^{-1}
Nitrate-N	4.53 mg kg^{-}
Phosphorus	3.21 mg kg^{-1}
Potassium	121 mg kg^{-1}
Organic matter	0.125 to 0.625

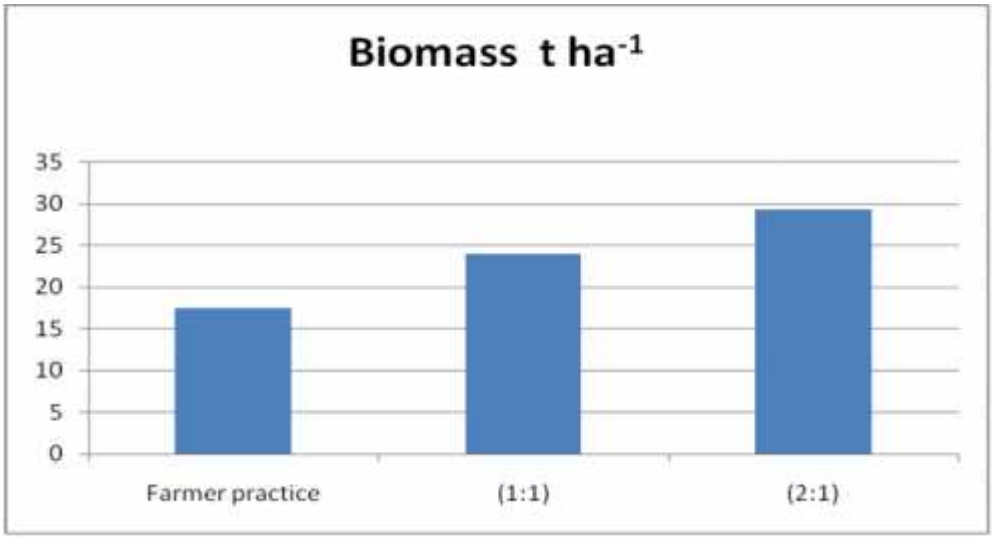
Bulk density	1.38 g cm^{-3}
Infiltration rate	35.3 mm hr^{-1}



Sorghum Biomass



Biomass of Millet



EXPERIMENT # 3.4	
TITLE	**Effect of cowpea as mulch on wheat under rainfed condition**
OBJECTIVE	To study the effect of green manure as mulch on wheat under rainfed conditions
RESEARCH WORKERS	• Muhammad Rafique Sajjad • Ghulam Muhammad • Anwar ul haq Khalid
DURATION	2014-15 to 2016-17
LOCATION	SAWCRI Chakwal
METHODOLOGY	• Treatment/Methodology ➢ Control ➢ GM (Incorporation) ➢ GM as mulch with no till Recommended dose of fertilizer will be applied in all

	treatments
PARAMETERS	Soil: pH, ECe, OM, Available P, Ext K, Soil Texture at start of study Soil Moisture contents at wheat sowing, after 02 months, after 04 months and at harvesting stage. Plant: Biomass yield of cowpea Grain yield of wheat Straw yield and fertile tillers of wheat.

PREVIOUS YEAR RESULTS:

(Biomass of Cow pea)

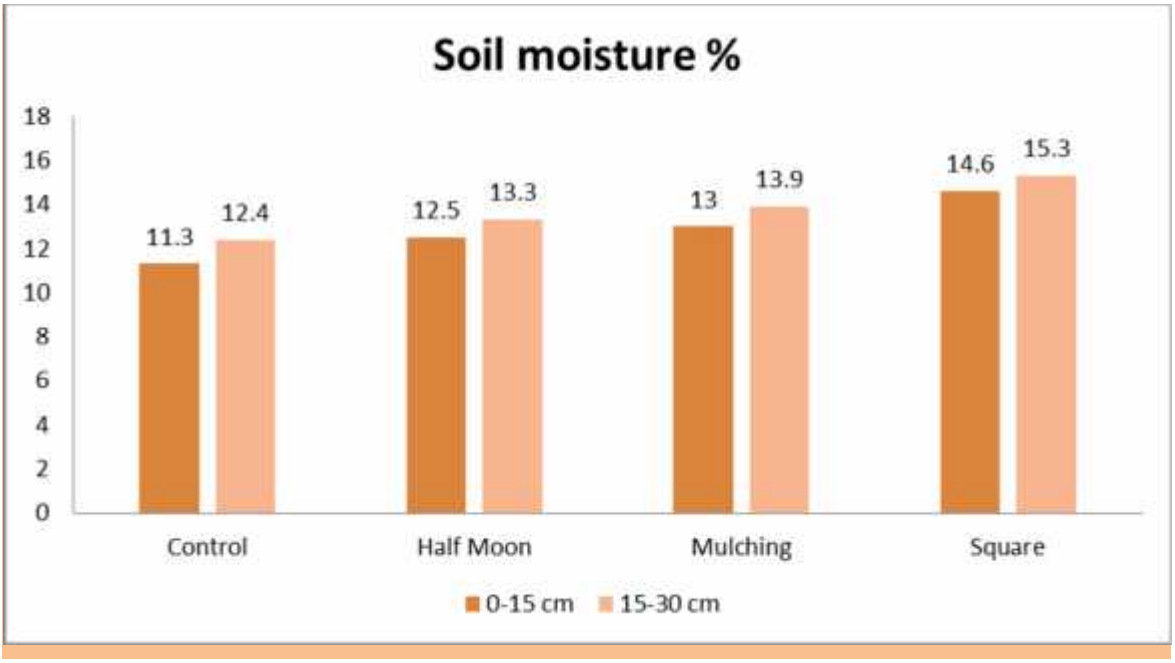
- T1 = no green manure
- T2 = 19.14 t ha^{-1}
- T3 = 18.49 t ha^{-1}

EXPERIMENT 3.5	
TITLE	**In situ moisture conservation practices on the fruit plant growth, moisture use efficiency under the rainfed conditions**
OBJECTIVE	To investigate the effect of different moisture conservation techniques on the plant growth, and how it facilitate them to control nutrient loss and soil erosion. Supplemental irrigation reduces due to the construction of different insitu moisture conserving technique.
RESEARCH WORKERS	• Safia Naureen Malik • Syed Zia ul Hasan
DURATION	• 2013-2016
LOCATION	• Olive orchard, Chakwal

METHODOLOGY	• **Treatments are tested with and without cover crop:** • T1 = Control • T2 = Half-moon terracing • T3 = Mulching with locally available grasses • T4 = Square micro catchments
PARAMETERS	• Soil mositure status will be determined at 0-15, 15-30 • pH, ECe, O.M, available P, extractable K and texture • Rainfall, Plant height, plant periphery and No. of fruits

PREVIOUS YEAR RESULTS:

MOISTURE PERCENTAGE



Theme # 4
Water Productivity

EXPERIMENT 4.1	
TITLE	**Supplemental irrigation on citrus production and quality using various irrigation techniques**
OBJECTIVE	Find out best irrigation technique for supplemental irrigation in medium rainfall area of Potowar
RESEARCH WORKERS	• Syed Zia ul Hasan • Dr. Riffat Bibi • Safia Naureen Malik
DURATION	2015-2019
LOCATION	Farmer field Wallana District Chakwal
METHODOLOGY	• **T1** : Drip irrigation • **T2** : Drip irrigation with micro catchments • **T3** :Bubbler irrigation • **T4** : Bubbler irrigation with micro catchments • Nutrients will be applied based on the requirements of fruit trees
PARAMETERS	• Rainfall data will be collected from SAWCRI weather station. • Irrigation scheduling • Soil analysis • Amount of water applied for each irrigation.(Ensure no water stress at any stage) • Water productivity(Kg m^{-3}) • Quality of fruit in term of size and juice.

PREVIOUS YEAR'S RESULTS	New experiment

EXPERIMENT 4.2	
TITLE	**Evaluation of different mulches to enhance the water productivity of stored rainwater**
OBJECTIVE	To enhance water use efficiency
RESEARCH WORKERS	• Safia Naureen Malik • Dr. Riffat bibi
DURATION	2015-2017
LOCATION	SAWCRI farm
METHODOLOGY	Green Chilli will be sown **Treatments** Control (1 bed) Plastic mulch (2 beds) Straw mulch (2 beds)
PARAMETERS	• Soil moisture %, NPK, • Crop yield parameters • Water productivity (applied)
PREVIOUS YEAR'S RESULTS	New experiment

SOIL & WATER CONSERVATION RESEARCH STATION, FATEHJANG

THEME # 1
SOIL AND WATER LOSSES MONITORING

EXPERIMENT-1.1

TITLE **LOSS OF SOIL NUTRIENTS AT DIFFERENT SLOPE GRADIENTS UNDER DIFFERENT CROP COVERS AND SOIL AMENDMENTS**

OBJECTIVES

1. Quantification of runoff water and sediment loss at different slope gradients
2. Quantification of soil nutrients loss through run-off of rain water against different soil amendments and crop covers at different slope gradients

RESEARCH WORKER (S):

1. Mrs. Rahina Kausar
2. Mr. Muhammad Rashid
3. Dr. Obaid ur Rehman

DURATION 2013-2018

LOCATION Soil and Water Conservation Research Station, Fateh Jang

METHODOLOGY

Layout of Experiment

1% Slope				**5% Slope**				**10% Slope**			
Control	Chemical Fertilizer	Compost	Gypsum	Control	Chemical Fertilizer	Compost	Gypsum	Control	Chemical Fertilizer	Compost	Gypsum
Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut

- Recommended rates of chemical fertilizer and compost were used
- Ground nut was sown in Kharif seasons

Runoff and soil loss was measured by using the standard runoff/erosion plots as described by Morgan (1996). The plot edges/borders were made of solid materials. The edges of the runoff plots were about 10 cm above the soil surface to prevent input from splashes entering the plot from the

surrounding areas and were sufficiently embedded in the soil so the plot would not be shifted by alternate wetting and drying of the soil. Runoff and eroded sediments were channeled into the collecting tanks. Each runoff plot was 2 m in width and 5 m in length. Collected run off was measured for runoff and sediment yield after every rainfall > 20 mm. A sample of 200 ml was taken from the tank after thorough mixing to bring all the sediments into suspension. The sample was taken to the laboratory where the sediments were filtered, oven-dried at 105 ^{0}C and weighed and were analyzed for NPK and micronutrients (Zn, Fe, Mn and Cu).

Rainfall Measurement

Rainfall was measured at each catchment with Rain gauge

RESULTS

Soil Status at the start of experiment

pH	7.81
Bulk density	1.62 g cm^{-3}
O.M	0.81 %
EC_e	0.76 dS m^{-1}
P	5.0 mg Kg^{-1}
K	80 mg Kg^{-1}
Soil Texture	Sandy loam

Topography and soil amendment effect on soil sediment yield (t ha^{-1})

No. of storms>20mm	Rainfall (mm)	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum	Mean
12	715 mm April 14-Sep 14	1	2.11	1.23	1.09	1.00	**1.36**
		5	2.23	2.00	1.22	1.12	**1.64**
		10	5.02	2.43	2.32	1.87	**2.91**
		Mean	**3.12**	**1.89**	**1.54**	**1.33**	

Topography and soil amendment effect on water runoff (m^3 ha^{-1})

No. of storms>20mm	Rainfall (mm)	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum	Mean
12	715 mm April 14-Sep 14	1	302.12	266.21	238.53	210.12	**254.25**
		5	357.25	300.37	286.28	258.50	**300.60**
		10	521.10	402.80	374.30	370.30	**417.13**
		Mean	**393.49**	**323.13**	**299.70**	**279.64**	

Topography and soil amendment effect groundnut grain yield (Kg $acre^{-1}$)

No. of storms>20mm	Rainfall (mm)	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum	Mean
12	715 mm April 14-Sep 14	1	325	687	566	530	**527 a**
		5	428	569	506	509	**503 b**
		10	363	583	499	483	**482 c**
LSD for Treatments=90.18		**Mean**	**372 c**	**613 a**	**524 ab**	**507 b**	**LSD for Slopes=16.33**

Topography and soil amendment effect on groundnut straw yield (Kg acre^{-1})

No. of storms>20mm	Rainfall (mm)	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum	Mean
12	715 mm April 14-Sep 14	1	474	695	642	670	**620 a**
		5	518	628	630	624	**600 a**
		10	468	627	576	563	**559 b**
LSD for amendment =19.05		**Mean**	**487 c**	**650 a**	**616 b**	**619 b**	**LSD for Slopes=20.70**

Topography and soil amendment effect on soil macronutrient loss (Kg ha^{-1})

Slope Gradients (%)	Control			Chemical Fertilizer			Compost			Gypsum			Mean
	N	P	K	N	P	K	N	P	K	N	P	K	
1	0.96	0.23	3.1	1.74	0.84	5.2	0.61	0.41	4.8	0.42	0.27	3.9	**2.35**
5	1.12	0.56	3.9	3.02	1.23	7.1	0.70	0.70	4.8	0.74	0.55	4.2	**2.57**
10	1.43	0.87	5.7	3.22	1.40	8.6	0.96	0.80	5.3	0.87	0.58	5.4	**3.04**
Mean	**1.17**	**0.55**	**4.23**	**2.66**	**1.16**	**6.97**	**0.76**	**0.64**	**4.97**	**0.68**	**0.47**	**4.50**	

Topography and soil amendment effect on soil micronutrient loss (Kg ha^{-1})

Slope Gradients (%)	Control				Chemical Fertilizer				Compost				Gypsum				Mean
	Zn	Cu	Mn	Fe	Zn	Cu	Mn	Fe	Zn	Cu	Mn	Fe	Zn	Cu	Mn	Fe	
1	0.08	0.23	0.23	0.19	0.12	0.42	0.37	0.65	0.19	0.50	0.23	0.32	0.12	0.42	0.23	0.22	**0.25**
5	0.22	0.42	0.28	0.31	0.37	0.52	0.62	0.61	0.23	0.66	0.31	0.62	0.18	0.55	0.32	0.29	**0.34**
10	0.31	0.60	0.34	0.51	0.71	0.65	0.84	0.74	0.55	0.87	0.50	0.60	0.18	0.62	0.50	0.36	**0.42**
Mean	**0.20**	**0.42**	**0.28**	**0.34**	**0.40**	**0.53**	**0.61**	**0.67**	**0.32**	**0.68**	**0.35**	**0.51**	**0.16**	**0.53**	**0.35**	**0.29**	

EXPERIMENT # 1.2	
TITLE	**HIGH EFFICIENCY IRRIGATION TECHNIQUES FOR**

	CITRUS ORCHARD TREES
OBJECTIVE	• To enhance water use efficiency • To enhance fertilizer use efficiency
RESEARCHERS	1. Mr. Muhammad Imran Akram 2. Mr. Muhammad Rashid 3. Dr. Obaid ur Rehman
DURATION LOCATION METHODOLOGY	2015 to 2020 BARS Fateh Jang **Treatments** • Pitcher irrigation (5 L Capacity Clay Pitcher) • Perforated plastic sleeve irrigation ($3^{//}$ dia plastic pipe up to feet depth with 10 holes of 10mm) • Bottle irrigation (Drink bottles with multiple hole of 10 mm dia) • Drip irrigation .Bucket irrigation (hanged at 1 m height with narrow tube) .Basin irrigation
PARAMETERS **Results**	• Soil moisture contents (at interval of 1 month) • Organic matter content • NPK • Fruit tree yield parameters • Water Productivity New Trial

THEME # 2
SOIL CONSERVATION

EXPERIMENT # 2.1	
TITLE	**ASSESSMENT OF GULLY EROSION IN POTOHAR**

OBJECTIVE(S):	• To quantify the status of gully erosion in Potohar. • To study the temporal variation in gully dimension under different land use and soil.
RESEARCH WORKERS	Mr. Muhammad Rashid
DURATION:	2015-2025
LOCATION:	Tehsil Fateh Jang
METHODOLOGY	• Topographic survey of the area • Catchment area • No of gullies in catchment, gully density • Length, width & depth of gullies • Rain gauges will be installed to measure monthly rainfall • Soil texture, Infiltration rate, soil moisture, bulk density and sediment load
PREVIOUS YEAR'S RESULTS	New experiment

EXPERIMENT # 2.2	
TITLE	**SELECTION OF EFFECTIVE LIVE BARRIER GRASSES SPECIES FOR CONTROLLING SOIL AND WATER EROSION AND THEIR IMPACT ON SOCIO-ECONOMIC CONDITION OF THE FARMERS**
OBJECTIVE (S)	Screening of grasses under natural conditions for providing vegetative cover, palatability to livestock and biomass production
RESEARCH WORKERS	1. Mrs. Rahina Kausar 2. Mr. Muhammad Imran Akram 3. Dr. Obaid ur Rehman
DURATION	2013-2018

LOCATION	Fateh Jang, Attock
METHODOLOGY	Various grasses, which can tolerate moisture stress and can adopt the climate, were tested for suitability. The grasses species were selected on the basis of their economic contribution and use. The promising species will be tested for vegetative structures, watts and bunds and their palatability to livestock and other suitable uses **Grasses Species** Paltosa, Vetiver, Panicum, Canckrus, **Observations and data collection** Observations on biomass, survival habits, spreading ability, Height and economic use were assessed.

RESULTS

Physico-chemical analysis of selected site

pH	7.96
Bulk density	1.61 g cm^{-3}
O.M	0.77 %
EC_e	1.08 dS m^{-1}
P	4.9 mg Kg^{-1}
K	87 mg Kg^{-1}

Sr. #	Name	Plant Height (cm)	Plant canopy (cm)	Biomass (t ha^{-1})
1	**Paltosa**	116.30 b	105.50 a	1.89 b
2	**Vetiver**	227.80 a	124.10 a	3.48 a
3	**Panicum**	171.10 ab	106.70 a	2.14 ab
4	**Canckrus**	104.50 b	56.90 b	2.43 ab
LSD		**82.88**	**35.88**	**1.42**

EXPERIMENT# 2.3

TITLE **SOIL IMPROVEMENT WITH CROP RESIDUE MANAGEMENT IN THE CLIMATE CHANGE AND FOOD SECURITY**

OBJECTIVE (S)

To assess the potentials of crop residue incorporation in soil for carbon sequestration

To evaluate the impact of crop residue addition soil physical, chemical and hydrological properties and on crop productivity

RESEARCH WORKERS

1. Mr. Muhammad Imran Akram
2. Mr. Muhammad Rashid
3. Dr. Obaid ur Rehman

DURATION

2014-2019

LOCATION

Fateh Jang

METHODOLOGY:

Treatments

Tr.	Crop Residue input (%)	Fertilizer Inputs
T_1	0	Rec. NPK 100%
T_2	25	Rec. NPK 50%
T_3	50	Rec. NPK 50%
T_4	100	Rec. NPK 50%
T_5	100	Rec. NPK 25%

Layout and designing

Experiment will be conducted in Mungbean-Wheat cropping sequence in RCBD arrangement

Measurements

Soil physical Properties

Bulk Density (Core method)
Aggregate Stability (Wet Sieving)
Infiltration Rate
Saturated Hydraulic Conductivity

Soil Chemical Properties

pH, SOM and NPK

Crop Yield

Grain & Straw yield

Results

Basic soil analysis

Soil Depth	pH	EC ($d\ Sm^{-1}$)	K ($mg\ Kg^{-1}$)	P ($mg\ Kg^{-1}$)	O.M (%)	Moisture (%)
0-6	7.58	0.98	60	2.9	0.80	4.90
6-12	7.46	0.05	80	2.9	0.81	5.69
0-6	7.70	0.61	100	2.5	0.78	4.96
6-12	7.69	0.76	80	3.1	0.80	5.89
0-6	7.76	0.87	80	3.2	0.79	4.81
6-12	7.70	0.89	60	2.8	0.80	5.76

Effect of crop residue incorporation on Mungbean

Treatments	Plant height (cm)	Grain yield ($Kg\ acre^{-1}$)	Straw yield ($Kg\ acre^{-1}$)
T_1 CR0 &NPK100	33	278	1237
T_2 CR25 &NPK 50	32	268	1252
T_3 CR50&NPK50	38	280	1243
T_4 CR100 &NPK50	34	284	1235
T_5 CR100 &NPK 25	32	272	1236
LSD	10.99 NS	60.43NS	161.8 NS

THEME # 3
WATER CONSERVATION

EXPERIMENT # 3.1	
TITLE	**POTENTIALS AND PROSPECTS OF CHEMICALS FOR SOIL MOISTURE CONSERVATION UNDER RAINFED CONDITIONS**
OBJECTIVE	To study the effect of Hydrogels application for soil moisture conservation and its impact on citrus growth
RESEARCHERS	1. Mr. Muhammad Rashid 2. Mrs. Rahina Kausar 3. Dr. Obaid ur Rehman
DURATION:	2010 to 2015

LOCATION:	Farmer Fields at *Muqaam* (Fateh Jang)
METHODOLOGY	**Treatments** T_1 Control (Untreated) T_2 Qemisoyl @ 100g plant^{-1} T_3 Soil Magic @ 100g plant^{-1} •Recommended dose of hydrogels were mixed into the soil under the canopy area of all selected five plants up to depth of 60cm. •Recommended fertilizers were added @ 500-250-250 NPK per plant respectively. **Soil analysis:** ECe, pH, Bulk density, O.M, before application of Hydrogels and periodical soil moisture contents (%) were recorded before application of Hydrogels and at interval of one month up to the depth of 60 cm after application of Hydrogels. **Parameters** • Plant height and Periphery • Number of fruits per plant

SOIL ANALYSIS BEFORE APPLICATION OF HYDROGELS

pH	7.71
Bulk density	1.56 g cm^{-3}
O.M.	0.68%
EC_e	0.64 dS m^{-1}

Periodical moisture contents (30 days interval) after hydrogel application

Date	Depth (cm)	Control	Qemisoyl	Soil Magic
		Mean (5 Plants)	Mean(5 Plants)	Mean(5 Plants)
1.4.14	0-15	7.74	9.85	9.45
	15-30	7.81	1023	9.58
	30-45	8.00	11.00	9.63
	45-60	8.12	11.13	10.01
1.5.14	0-15	7.43	9.12	9.10
	15-30	7.50	9.23	9.12
	30-45	7.85	9.40	9.17
	45-60	7.90	10.12	9.84
1.6.14	0-15	7.40	10.33	9.96
	15-30	7.39	10.68	10.11
	30-45	7.46	11.00	10.19
	45-60	7.56	12.17	10.77
1.7.14	0-15	8.01	12.22	11.51
	15-30	8.11	12.46	11.62
	30-45	8.16	12.94	11.74
	45-60	8.33	13.00	11.88
1.8.14	0-15	9.22	15.30	13.65
	15-30	9.43	15.55	13.96
	30-45	9.96	15.74	14.02
	45-60	10.00	15.78	14.23
1.9.14	0-15	9.22	14.28	13.23

	15-30	9.36	14.45	13.36
	30-45	9.54	14.51	13.55
	45-60	9.67	14.68	13.71

Effect of Hydrogels on citrus plants

Sr. No	Treatments	Fruit plant	# of Plants	Av. Plant height (m)	Avg. plant canopy (m)	No. Fruit Plant^{-1}
1	**Control**	Blood Red	5	2.91	16.61	171.67
2	**Qemisoyl**	Blood Red	5	3.23	19.07	258.00
3	**Soil Magic**	Blood Red	5	3.16	17.01	234.00

EXPERIMENT # 3.2	
TITLE	**FATE OF PHOSPHATIC FERTILIZERS UNDER DIFFERENT RAINFALL REGIMES OF THE RAINFED REGION**
OBJECTIVE (S)	Fate of different phosphatic fertilizers sources under different moisture and rainfall regimes and their FUE
RESEARCH WORKERS	1. Mr. Muhammad Imran Akram 2. Mr. Muhammad Rashid 3. Dr. Obaid ur Rehman
DURATION	2013-2018
LOCATION	• High Rainfall Zone • Medium Rainfall Zone • Low Rainfall Zone
METHODOLOGY	**Treatments** **T_1 Control** **T_2 SSP** **T_3 DAP** **T_4 Nitrophos** All the fertilizer nutrients were applied as basal dose while the recommended rates of nitrogen were supplemented by urea. **Rainfall Measurement** Rainfall was measured during the growing season on monthly basis at all the study locations. **Soil Analysis** Soil samples were collected and analyzed for: • Saturation % (Before sowing) • OM (Before sowing) • P (at 1 month interval)

	Crop Parameters • Grain yield (Kg ha^{-1}) • Straw yield (Kg ha^{-1}) **Fertilizer Use Efficiency** Fertilizer use efficiency for each crop under each rainfall zone will be calculated: **Cost of Fertilizer Applied / Cost of Crop Output X 100**
PREVIOUS YEAR/S RESULTS	

Soil analysis at the start of experiment

Parameter	High rainfall zone	Medium rainfall zone	Low rainfall zone
pH	7.81	7.72	7.69
Saturation %	18	16	16
O.M (%)	0.90	0.82	0.78
P_2O_5 (mg Kg^{-1})	4.3	3.4	4.1

Effect of P sources on Mung grain yield (Kg $acre^{-1}$) at different rainfall regimes

Treatments	High rainfall zone	Medium rainfall zone	Low rainfall zone
Control	318 b	231	152 b
DAP	475 a	312	219 a
SSP	423 ab	242	151 b
NP	447 ab	270	161 ab
LSD	135.7	131.4 NS	61.59

Effect of P sources on Mung straw yield (Kg $acre^{-1}$) at different rainfall regimes

Treatments	High rainfall zone	Medium rainfall zone	Low rainfall zone
Control	1328	1249	1164
DAP	1563	1396	1311
SSP	1477	1311	1194
NP	1676	1352	1239
LSD	536.7 NS	580.6 NS	476.6 NS

Effect of P sources on FUE at different rainfall regimes

Treatments	High rainfall zone	Medium rainfall zone	Low rainfall zone
Control	-	-	-
DAP	20.66	13.56	9.54
SSP	18.39	10.53	6.57
NP	19.42	11.73	6.99

Effect of P sources on soil available P at different rainfall regime

Treatments	Low Rainfall Zone				Medium rainfall Zone				High Rainfall Zone			
	Pre Sow	30 DAS	60 DAS	Post Har	Pre Sow	30 DAS	60 DAS	Post Har	Pre Sow	30 DAS	60 DAS	Post Har
Control	3.1	3.1	3.3	3.0	3.6	3.5	3.4	3.2	4.0	3.8	3.5	3.2
DAP	3.6	3.8	4.0	4.1	4.0	4.4	4.3	4.8	4.9	5.2	5.0	5.3
SSP	3.8	3.6	3.8	3.8	3.6	3.8	3.4	3.6	4.4	4.6	4.7	4.4
NP	3.5	3.4	3.6	3.8	3.8	3.9	3.6	3.8	4.2	4.6	4.5	4.4

Effect of P sources on soil saturation % at different rainfall regimes at harvest

Treatments	High rainfall zone	Medium rainfall zone	Low rainfall zone
Control	20	18	15

DAP	26	22	18
SSP	20	20	16
NP	22	24	17

Effect of P sources on soil O.M % at different rainfall regimes at harvest

Treatments	High rainfall zone	Medium rainfall zone	Low rainfall zone
Control	0.72	0.69	0.62
DAP	0.94	0.90	0.83
SSP	0.86	0.82	0.76
NP	0.90	0.82	0.77

Rainfall (mm) at study sites

Month	High rainfall zone	Medium rainfall zone	Low rainfall zone
March	142	137	67
April	25	35	13
May	66	80	27
June	0	15	16
July	195	233	71
August	264	246	53
September	55	106	82
Mean	**107**	**122**	**47**

THEME # 4
WATER PRODUCTIVITY

EXPERIMENT # 4.1	
TITLE	**ASSESSMENT AND ENHANCEMENT OF WATER PRODUCTIVITY OF ARABLE VS HIGH VALUE CROPS USING SUPPLEMENTARY IRRIGATION**
OBJECTIVE	To quantify the comparative benefits of use of stored water for high value crops vs. arable crops
RESEARCHERS	1. Mr. Muhammad Rashid 2. Mrs. Rahina Kausar 3. Dr. Obaid ur Rehman
DURATION	2014-2019
LOCATION: METHODOLOGY	BARS Fateh Jang **Treatments**

	1. Arable crops 2.High value crops ➢ Water applied to each treatment (65 Lx 3 Times) ➢ Income & yield from vegetables and arable crops ➢ Citrus: Plant periphery, plant height, number of fruits and income etc.

Effect of supplementary irrigation on citrus plants

Sr.#	Farmer Name	Specie	No. of plants	Aver. Plant Height (m)	Aver. Plant canopy (m)
1	Mr. Altaf Hussain	Blood Red	83	4.08	14.51
2	Mr.Noor Muhammad	Blood Red	52	3.92	13.97

Comparative Benefits of Mr. Altaf Hussain Farm

Parameters	Arable crops	High Value crops	
	Wheat	Citrus	Berseem
Area	1 acre	1 acre	6 kanal
grain yield	23monds	1984 Dozen	
Income (Rs. Grain + straw)	27600	79360	7000
Expenditure	9000	23000	3200
Net Income	18600	56360	3800
Total income	**18600**	**56360+3800=60160**	
Additional Benefits	**60160-18600= Rs. 41560**		

Comparative Benefits of Mr. Noor Muhammad Farm

Parameters	Arable crops	High Value crops				
	Wheat	Citrus	Garlic	Carrot	Spinach	Radish
Area	1 acre	1 acre	4 Marla	4 Marla	6 Marla	5 Marla
Yield	19 monds	1068 Dozen	-			

Income (Rs. Grain + straw)	22800	42720	8000
Expenditure	11000	18500	2500
Net Income	11800	24220	5500
Total income	**11800**	**24220+5500=29720**	
Additional Benefits	**29720-11800=17920**		

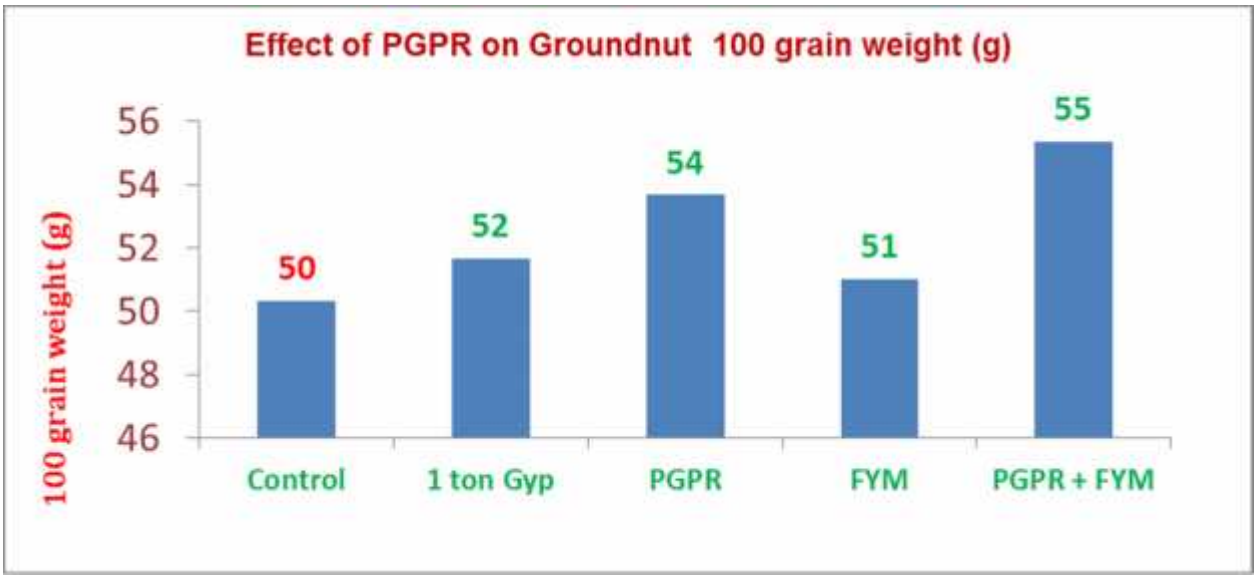
EXPERIMENT # 4.2	
TITLE	**EFFECT OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) CONTAINING ACC-DEAMINASE ACTIVITY FOR IMPROVING GROUNDNUT YIELD UNDER RAINFED CONDITIONS**
OBJECTIVE	To study the effect of ACC Deaminase activity in Pothowar region for the improvement of groundnut yield
RESEARCHERS	1. Mr. Muhammad Rashid 2. Mrs. Rahina Kausar 3. Dr. Obaid ur Rehman
DURATION	2014-2019
LOCATION: METHODOLOGY	Fateh Jang **Treatments** **1. Control** **2. PGPR inoculation** **3. FYM + PGPR inoculation** **4. FYM** **5. Gypsum @ 1 ton acre^{-1}**

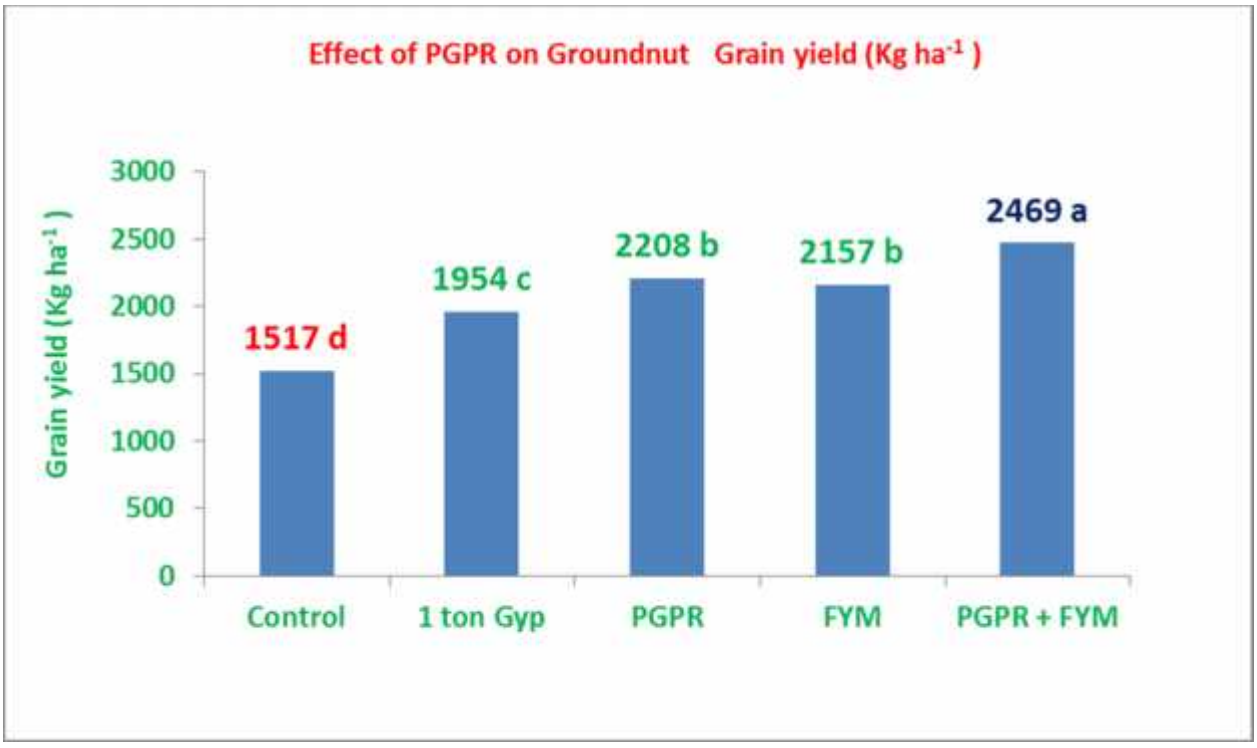
Physico-chemical analysis of selected site

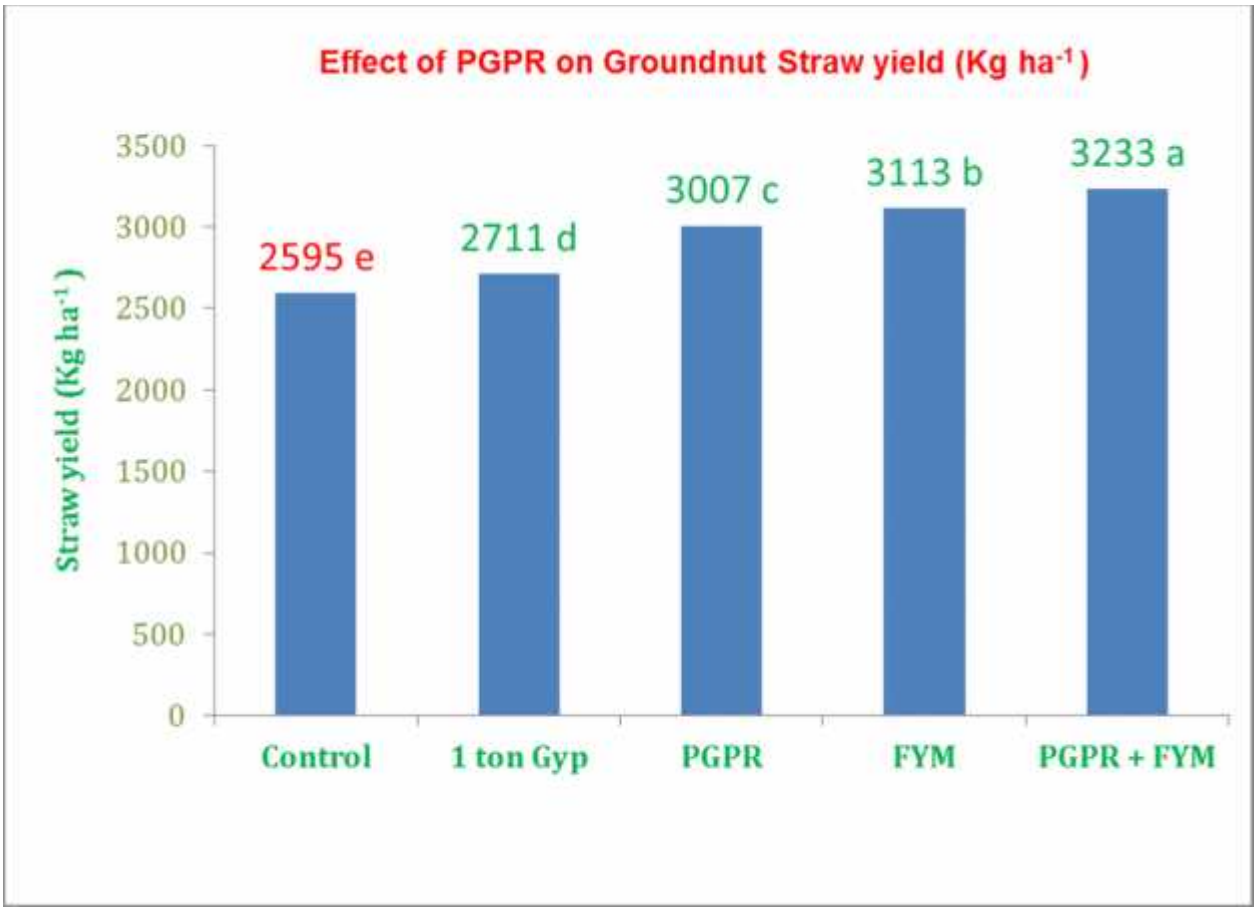
pH 8.10

Bulk density 1.58 g cm^{-3}

O.M	0.85 %
EC_e	0.78 dS m^{-1}
P	3.9 mg Kg^{-1}
K	97 mg Kg^{-1}






Effect of PGPR on Groundnut Straw yield (Kg ha-1)
Straw yield (Kg ha-1)
3500
3000
2500
2000
1500
1000
500
0
2595 e
2711 d
3007 c
3113 b
3233 a
Control
1 ton Gyp
PGPR
FYM
PGPR + FYM

SOIL & WATER CONSERVATION RESEARCH STATION SOHAWA

THEME # 1

SOIL AND WATER LOSSES MONITORING

EXPERIMENT #1.1	**ASSESSMENT OF RUNOFF AND SOIL LOSS IN RUNOFF PLOTS UNDER DIFFERENT VEGETATION COVERS**
OBJECTIVE	To quantify the extent of surface runoff and soil loss under different slope gradients and crop covers
RESEARCH WORKERS	Mr. Adnan Umair Mr. Kashif Bashir Agri. Chemist
DURATION:	2009-2015
LOCATION:	Village Hafial, (G. khan).
METHODOLOGY	Runoff plots Crop covers S_1 = 1% T1 = Fallow (tilled) S_2 = 5% T2 = mash S_3 = 10% T3 = mung T4= millet • Runoff and soil loss will be recorded after each storm • Root growth, biomass and grain yield of each cover crop will be recorded at maturity

PREVIOUS YEAR'S RESULTS

Table- Effect of slope gradients and cover crops on soil loss (t ha^{-1}) with rainfall (kharif 2014)

No. of storm	Rainfall (mm)	Slope Gradients	Soil loss (t ha^{-1})				
			Fallow	Mung	Mash	Millet	Mean
16	972.2 June 15, 2014 to October 15, 2014.	1 %	2.50	2.19	1.72	1.75	2.03
		5%	3.08	2.73	2.59	2.39	2.70
		10%	3.68	3.46	3.05	3.26	3.36
		Mean	3.08	2.79	2.46	2.46	

Effect of slope gradients and cover crops on water losses with rainfall (kharif 2014).

No. of storm	Rainfall (mm)	Slope Gradients	Water loss (m^3/ha)				
			Fallow	Mung	Mash	Millet	Mean
16	972.2 June 15, 2014 to October 15, 2014	1 %	36.97	31.02	34.83	36.32	34.78
		5%	48.47	43.00	45.25	46.74	45.86
		10%	59.94	47.76	54.57	53.42	53.92
		Mean	48.46	40.59	44.88	45.50	

Table-Effect of slope gradients on <u>biomass yield</u> of cover crops (kharif 2014).

No. of storm	Rainfall (mm)	Slope Gradients	Biomass yield (kg ha^{-1})			
			Mung	Mash	Millet	Mean

16	972.2 June 15, 2014 to October 15, 2014	1 %	1706	3438	5720	3621
		5%	1694	3181	4976	3283
		10%	1498	2912	4357	2922
		Mean	1632	3177	5018	

Table-Effect of slope gradients on grain yield of cover crops (kharif 2014).

No. of storm	Rainfall (mm)	Slope Gradients	Grain yield (t ha^{-1})			
			Mung	Mash	Millet	Mean
16	972.2 June 15, 2014 to October 15, 2014	1 %	1.99	0.59	0.27	0.95
		5%	1.87	0.49	0.24	0.86
		10%	1.79	0.43	0.21	0.81
		Mean	1.89	0.50	0.24	0.00

THEME # 2
SOIL CONSERVATION

EXPERIMENT # 2.1	
TITLE	**ASSESSMENT OF GULLY EROSION IN POTOHAR**
OBJECTIVE(S):	• To quantify the status of gully erosion in Potohar. • To study the temporal variation in gully dimension under different land use and soil.
RESEARCH WORKERS	Dr. Adnan Umair
DURATION:	2015-2025
LOCATION:	Tehsil Gujar Khan, Sohawa and Deena
METHODOLOGY	• Topographic survey of the area • Catchment area • No of gullies in catchment, gully density

	• Length, width & depth of gullies • Rain gauges will be installed to measure monthly rainfall • Soil texture, Infiltration rate, soil moisture, bulk density and sediment load
PREVIOUS YEAR'S RESULTS	New experiment

EXPERIMENT # 2.2	**EVALUATING THE FARM RUNOFF STRUCTURES FOR WATER HARVESTING AND SOIL CONSERVATION AT FARMER FIELD LEVEL IN HIGH RAINFALL AREA.**
OBJECTIVE	Participatory evaluation of the performance of farm runoff structures at farmers fields for damage reduction and farm runoff management
RESEARCH WORKER	Adnan Umair Agri. Chemist
DURATION:	Continuous
LOCATION:	Khabbal, Jermot, Khallabutt, Dhoke Mian Jewan, Mohra viru, Ladder, Sakhra, Bhit Sher Ali, Hafial.
METHODOLOGY	Peak discharge of water to be passed was calculated by using rational formula Q = CIA where Q is discharge, C is the coefficient which is taken as 0.4 for medium as 4 inches per hour (highest possible in the area) and A is area in acre. In this way the form of equation will be Q = 1.6 A. Type of structures was designed on the basis of peak discharge of water, fall type of soil. The size of structures were determined by using the standardize graph developed by SAWCRI, Scientists.
OBSERVATION & DATA COLLECTION	The observations include the rainfall, runoff to be passed, and runoff marks, in addition to the data on structures performance. The performance will be observed by recording: 1. Displacement of

	stones 2. Settlement of stones due to undermining or surface soil loss. 3. Erosion/gully development at down stream and up stream of the structures. 4. Hydrological and drainage performance of structures. 5. Yield of crop (what ever the farmer sows in field **with-structure**) in upper field in relation to control (what ever the farmer sows in the field **without-structure.**
QUANTITATIVE ASSESSMENT	i. Estimation of Soil Moisture: Soil moisture will be recorded up to the depth 120 cm in fields with structure and without structures (Control). ii. Soil Erosion Estimation: Soil loss will be estimated as a result of erosion through measuring the size of gullies etc. iii. Crop Yield: Millet will be sown at all sites with following treatments and yield will be recorded. • Farmer's practice in field with structure. • Farmer's practice in field without structures (Control). • Recommended practice in field with structure. • Recommended practice in field without structure (Control

PREVIOUS YEAR'S RESULTS/ACCOMPLISHMENTS:

- The highest rainstorm caused the following sheet/rill erosion at upstream of the structure during July, 2014.

Sites	Structure No.	Dimension of sheet/rill erosion (cm)			Rainfall (mm)
		Length	Width	Depth	
khabbal	3	175	18.5	15.50	187
Jermote	2	148	17.3	17.50	133

Table: Height of water passed over the crest

Sites	Height of water passed over the crest	Rainfall (mm)
Khabbal	6.3 to 15 cm	938
Jermot Kalan	2.2 to 7.4 cm	820
Khalla Butt	6.2 to 13 cm	867
Dhoke Mian Jewan	2.5 to 7.7 cm	938
Mohra Viro	2.4 to 9.2 cm	802
Hafial	3.2 to 9.4 cm	802

SALIENT OBSERVATION OF STRUCTURES

- Performance of all structures remained satisfactory at Khabbal, Jermot Kalan Khallabutt, Dhoke Mina Jewan, Mohra Viro, Laddhar & Bhit Sher Ali.
- Major rainfall events occurred in July and August, 2014.
- No displacement of stones was observed during monsoon rainfall
- Natural grass growing in these structures has strengthened the structures.

Soil moisture contents (%) before sowing of millet at structure and without structure fields (kharif 2014)

S. No	Name of Farmer	Depth (cm)	Structure		Without Structure	
			Recommended Dose	Farmer Practice	Recommended Dose	Farmer Practice
1	M. Sajjad	0-15	9.55	11.15	9.00	9.15
		15-30	10.00	11.40	10.20	10.00
2	M. Banarus	0-15	10.27	9.70	10.00	9.70
		15-30	10.90	10.20	12.20	10.60

3	Wajid	0-15	10.70	9.90	9.00	9.15
		15-30	11.45	11.00	9.70	9.55

Table: Crop yield recorded at various sites of structures (Kharif 2014)

Farmer Name	Crop	Grain yield (kg ha^{-1})			
		With structure		Without structure	
		Recommended Dose of Fertilizer	Farmer Practice	Recommended dose of Fertilizer	Farmer Practice
M. Sajjad	Millet	954	913	904	881
Wajid	Millet	927	886	877	854
M. Banarus	Millet	1021	977	967	942
Mean		967	925	916	892

DROP OF FWCS (FIELD TO FIELD)

Site	Total No. of Structures	Drop of Structures	No. of Structures
Khabbal	05	Less than 5 feet	05
Jermot Kalan	07	Less than 5 feet	03
		5-10 feet	04
Khallabutt	05	Less than 5 feet	02
		5-10 feet	03
Dhoke Mian Jewan	05	Less than 5 feet	03
		5-10 feet	02
Mohra Viro	05	Less than 5 feet	04
		5-10 feet	01
Ladder	03	Less than 5 feet	01

		5-10 feet	02
Bhit Sher Ali	03	Less than 5 feet	02
		5-10 feet	01
Hafial	01	Less than 5 feet	01
G.Total	**34**		

EXPERIMENT # 2.3	**SCREENING OF VARIOUS GRASSES AGAINST MOISTURE STRESS**
OBJECTIVE	Screening of grasses under natural conditions for providing vegetative cover, palatability to livestock and biomass production.
RESEARCH WORKER	Adnan Umair Agricultural Chemist
DURATION:	2008-2015
LOCATION:	Sohawa (Jhelum)
METHODOLOGY	Various grasses having ability to tolerate moisture stress will be tested for suitability. The promising species will be tested for vegetative structures, watts, bund and palatability to livestock.
OBSERVATION & DATA COLLECTION	Observation on biomass yield and growth habits will be recorded during growth period under rainfed conditions.

S.No.	Grass Species	Technical name
1	Palwan	*Bothriochloa pertursa*
2	Baru	*Sorghum halepense L.*
3	Mott	*Pennisetum perpureum Cv. dot mott*
4	Babbar	-
5	Kai	*Typha latifolia*
6	Suryala	*Hetropogon contortus*
7	Khabbal	*Cynodon dactylon*
8	Khavi	*C. schoenanthus*
9	Chingan	-
10	Madhana	*Dactyloctenum ageyptium*
11	Lemon grass	*Cymobopogon citrates*

PREVIOUS YEAR'S RESULTS/ACCOMPLISHMENTS:

Table- Biomass yield, plant height and spreading of various grasses for Kharif, 2014.

S.No	Grass Species	Biomass yield (t/ha)	Height /Plant (m)	Spreading/Plant (m)
1	Mott	14.47	0.98	0.74
2	Lemon	3.51	0.40	0.45
3	Kai	2.78	0.81	0.56
4	Khabbal	3.18	0.23	0.12
5	Suryala	2.52	0.48	0.33
6	Vetiver (khaskhas)	3.12	0.75	0.54
7	Chingan	4.48	0.71	0.39
8	Babbar	2.25	0.43	0.35
9	Khavi	1.30	0.57	0.26
10	Madhana	2.30	0.64	0.28

11	Palwan	0.42	0.53	0.25

EXPERIMENT No. 2.4	**RESTORATION OF ERODED LANDS THROUGH ORGANIC AMENDMENTS IN POTHWAR REGION**
OBJECTIVE	To evaluate the impact of traditional organic materials on soil conservation and yield of crops in eroded lands of the area
RESEARCH WORKERS	Agri.Chemist Kashif Bashir
DURATION	2013 - 2017
LOCATION	Eroded lands in Farmers fields in Tehsil Sohawa, district Jhelum. Cropping System of the Region. Wheat-Millet-Wheat-Millet (Jhelum)
METHODOLOGY	Data collection: Following treatments will be applied on selected site of eroded lands that lose upper soil surface through water erosion in farmer fields. T1 = Control T2 = Farm Yard Manure (15 t ha^{-1}) T3 = Poultry Litter (15 t ha^{-1}) T4 = Municipal Solid Waste Compost (15 t ha^{-1}) Parameters Rainfall at each site. Soil sampling (0-15 & 15-30 cm) before sowing of each crop for initial soil status for particular year (once only) Soil physical properties (Texture, Bulk density, Porosity, moisture content) Soil chemical properties (pH, EC, O.M, TOC). Yield and yield components of each crop at harvest.

PREVIOUS YEAR RESULTS:

Treatments	1000 seed wt (g)	Straw yield kg/ha	Seed Yield Kg/ha	Seed Yield t/ha
Control	7.78	4867	879	0.88
FYM	8.04	5117	912	0.91
Poultary Litter	8.24	5489	954	0.96
MSWC	8.03	4966	904	0.90
Mean	8.02	5110	913	0.91

THEME # 3

WATER CONSERVATION

EXPERIMENT No. 3.1	**RESPONSE OF OLIVE PLANTS TO GYPSUM APPLICATION.**
OBJECTIVE	To assess the effect of gypsum on fruit yield of olive plants and fertility status of soil.
RESEARCH WORKERS	1. Dr. Adnan Umair 2. Agri. Chemist
DURATION	2013-2018
LOCATION	Hafial
METHODOLOGY	T1: Control T2: Gypsum @ 5 kg/plant T3 Gypsum @ 10 kg/plant **Soil Parameters:** pH, EC, Calcium + Magnesium, Soil Moisture, Total Nitrogen, Available phosphorus, Extractable potassium

	Plant Parameters: Shoot diameter, Plant height, Fruit yield per plant. Water productivity

Previous Year Results:

Treatment	Plant height (cm)	Canopy diameter (cm)	Stem diameter (cm)
Control	460	275	51.2
Gypsum @ 2.5 kg/plant	468	460	57.94
Gypsum @ 5 kg/plant	480	312	57.92
Mean	470	349	55.69

Experiment # 3.2	**Response of Humic Acid application on crop growth and moisture conservation**
OBJECTIVE	To assess the effect of Humic acid on soil and moisture conservation under rainfed conditions
RESEARCH WORKERS	1. Dr. Adnan Umair 2. Agri. Chemist
DURATION	2015-2019
LOCATION	Thesil Sohawa
METHODOLOGY	T1 = Control T2 = HA @ 10 kg ha^{-1} T3 = HA @ 15 kg ha^{-1} T4 = HA @ 20 kg ha^{-1} **Soil Parameter** **Soil** pH, EC, Calcium + Magnesium, Soil Moisture, Total Nitrogen, Available phosphorus, Extractable potassium, **Plant Parameters:** Shoot diameter, Plant height, yield

Previous Year Results	First Year

THEME # 4
WATER PRODUCTIVITY

EXPERIMENT No.4.1	
TITLE	**ASSESSMENT AND ENHANCEMENT OF WATER PRODUCTIVITY OF ARABLE VS. HIGH VALUE CROPS USING SUPPLEMENTARY IRRIGATION.**
OBJECTIVES:	1. To quantify the water productivity of different arable and high value crops. 2. To quantify the economic benefits of use of stored water for high value crops vs. arable crops.
RESEARCH WORKER	1. Dr. Adnan Umair 2. Agri. Chemist
DURATION	2008-2015
LOCATION	One site in Khallabutt (Rawalpindi)
METHODOLOGY	**Treatments** 1.Arable crop under irrigated conditions 2.High value crops with supplemental irrigation (Citrus with intercropping of vegetables and fodder) **Data Collection** Rainfall No. of irrigations applied to each treatment. (Timing and duration of each irrigation) All variable costs including cost of labour, fuel, inputs ect. in each

	treatment. Income and yield of arable crop, fruit & vegetables. Plant height & periphery with No. of fruits/plant. Basin diameter of fruit plants to estimate rainwater received through rainfall. weight of fruit/plants (take sub-samples) **Water productivity (W.P)** W.P in each treatment will be calculated as: **W.P = Fruit yield (kg) / Water use (m^3)**

PREVIOUS YEAR'S RESULTS/ACCOMPLISHMENTS:

The position of sweet lime fruit plants is as follow.

S.No	PLANTS	TOTAL	EXISTING	Av. No of fruits/plant
1	Sweet lime	40	37	-

Table: Comparative benefit of high value crops vs arable crops.

	Arable crop	High value crops		
	Millet	Citrus	Tinda	Bitter gourd
Area	3 kanal	7.5 marla	5 marla	5 marla
Yield (kg)	-	--	101	35
Income (Rs)	4715	--	3238	1380
Expenditure (Rs)	1495	2875		
Net income (Rs)	3220	4618		
Expenditure (Rs/ha)	9967	115000		
Net Income (Rs/ha)	21467	184736		

Net Benefit	11500	69736
Difference (Rs/ha) = 69736 – 11500 = 58236		

Experiment # 4.2	**Response of Farm yard manure and gypsum application on soil structural properties**
OBJECTIVE	To assess the effect of traditional organic source (FYM) and gypsum on soil structure for soil and moisture conservation
RESEARCH WORKERS	1. Dr. Adnan Umair 2. Agri. Chemist
DURATION	2014-2019
LOCATION	Thesil Sohawa
METHODOLOGY	T1 = Control T2 = FYM @ 5 t ha^{-1} T3 = FYM @ 2.5 t ha^{-1} T4 = Gypsum @ 5 t ha^{-1} T5 = Gypsum @ 2.5 t ha^{-1} **Soil Parameters:** Mean weight diameter, aggregate stability, pH, EC, Calcium + Magnesium, Soil Moisture, Total Nitrogen, Available phosphorus, Extractable potassium. **Plant Parameters:** Shoot diameter, Plant height, yield

Treatment	1000 seed wt (g)	Straw yield kg/ha	Seed Yield Kg/ha	Seed Yield t/ha
Control	7.78	5305	958	0.96
FYM @ 5 t ha^{-1}	8.04	5578	994	0.99
FYM @ 2.5 t ha^{-1}	8.24	5983	1040	1.05
Gypsum @ 5 t ha^{-1}	8.03	5413	985	0.98
Gypsum @ 2.5 t ha^{-1}	8.02	5570	995	0.99
Mean	8.02	5569	989	0.97

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SAWCRI CHAKWAL

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THEME # 01

SOIL AND WATER LOSS MONITORING

EXPERIMENT # 1.1	
TITLE	**EVALUATION OF MECHANICAL CHECKDAMS FOR SOIL CONSERVATION PROSPECTIVES IN UNCULTIVATED GULLIED AREAS**
OBJECTIVES	➢ To assess gully bed development rate for gully farming in uncultivated gullied areas.
RESEARCH WORKERS	1. Engr. Dr. Sultan Ahmad Rizvi 2. Mr. Muhammad RafiqueSajjad 3. ShahidMunir
DURATION	2014-2019 prospective
LOCATION	BhattiGujjararea, District Chakwal
METHODOLOGY	➢ Site selection for development of check-dams during 2014-15. ➢ Topographic survey with GIS/GPS/total station support for i. Establishment of permanent benchmarks ii. Delineation of gully boundaries iii. Estimation of surface area exposed to erosion. iv. Estimation of bed development ➢ Improvement of check-dams as and when required during 2015-19. ➢ Seasonal information regarding bed development, crop/biomass development and moisture conservation in newly developed beds. ➢ All the information/data will be analyzed in relation to soil type, rainfall intensity/duration, surface area of gully exposed to erosion, catchment of the gulley, land use above gully and land use within the gully to come up with the rate of bed development in gully area

	➢ Reporting the results
PARAMETERS	Seasonal data collection for following parameters: 1. Surface area of gully 2. Land use above and within the gully 3. Catchment area feeding to gully erosion 4. Bed development 5. Land use (crop/biomass development) 6. Soil moisture 7. Soil Fertility assessment (ECe, pHs, OM, Texture, Available P and Extractable K). 8. Rainfall data.

PREVIOUS YEAR'S RESULTS

	
Pictorial view of gully	Placement of check dams

	
Land use	Bed development

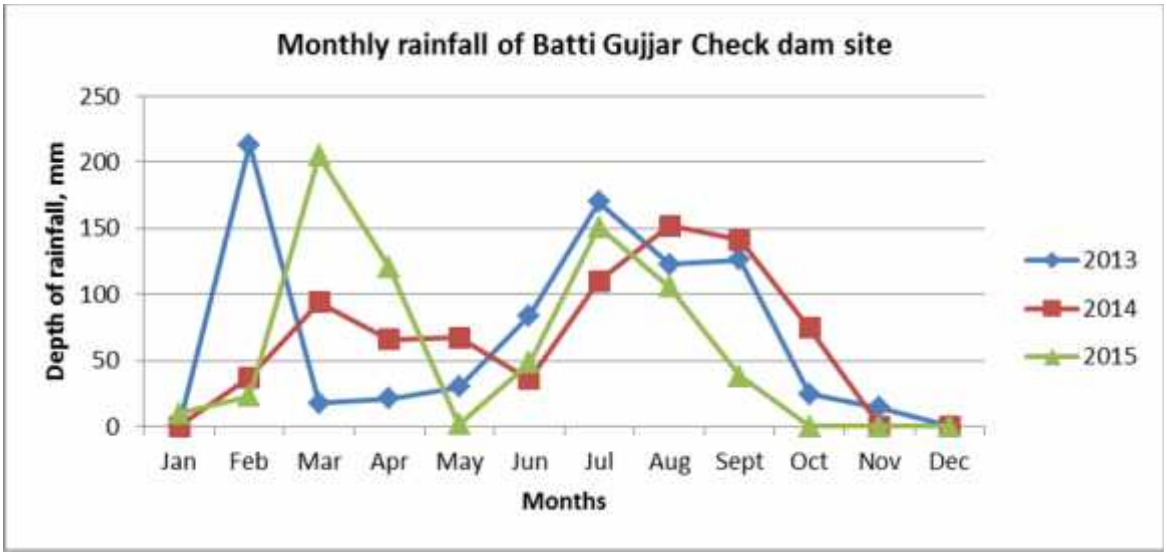
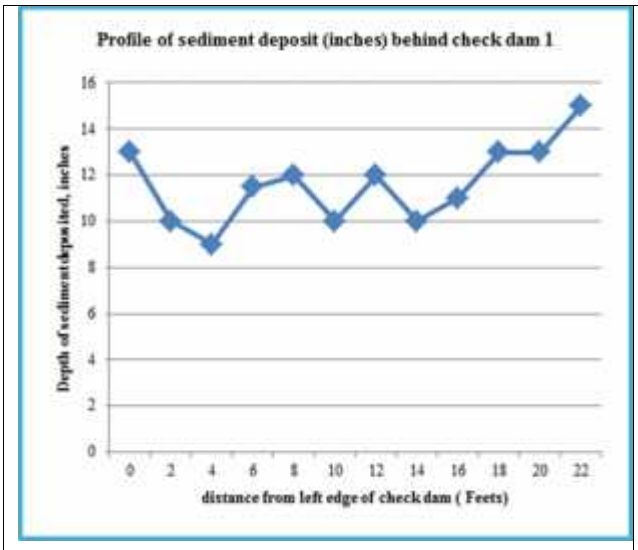
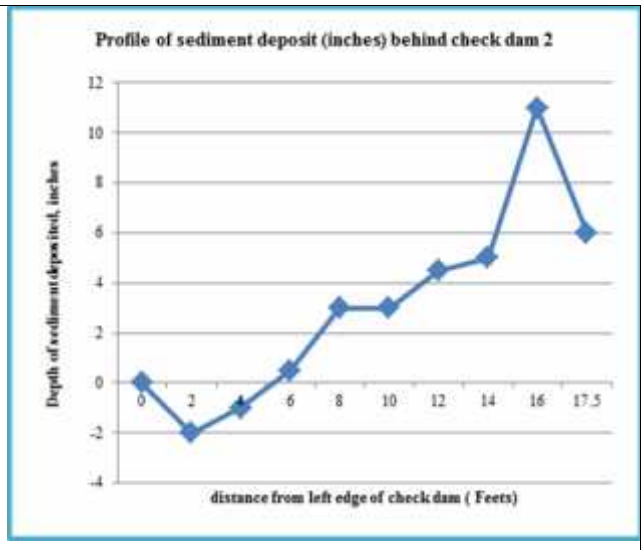
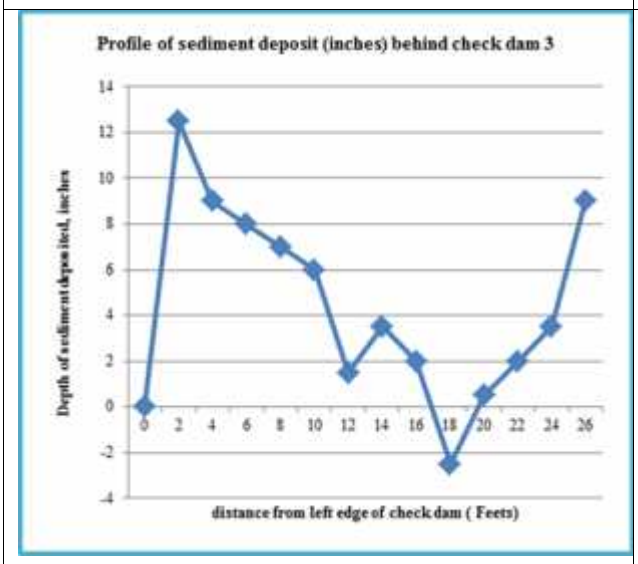


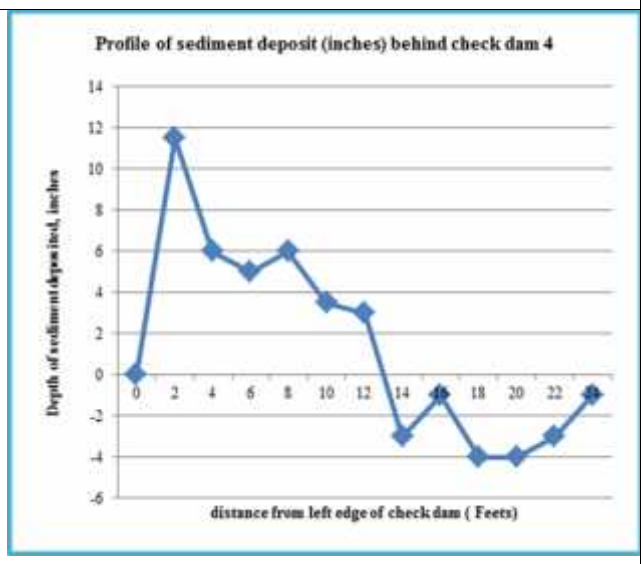
Figure 1.1 Monthly rainfall records in mm at check dam site of BhattiGujjar area

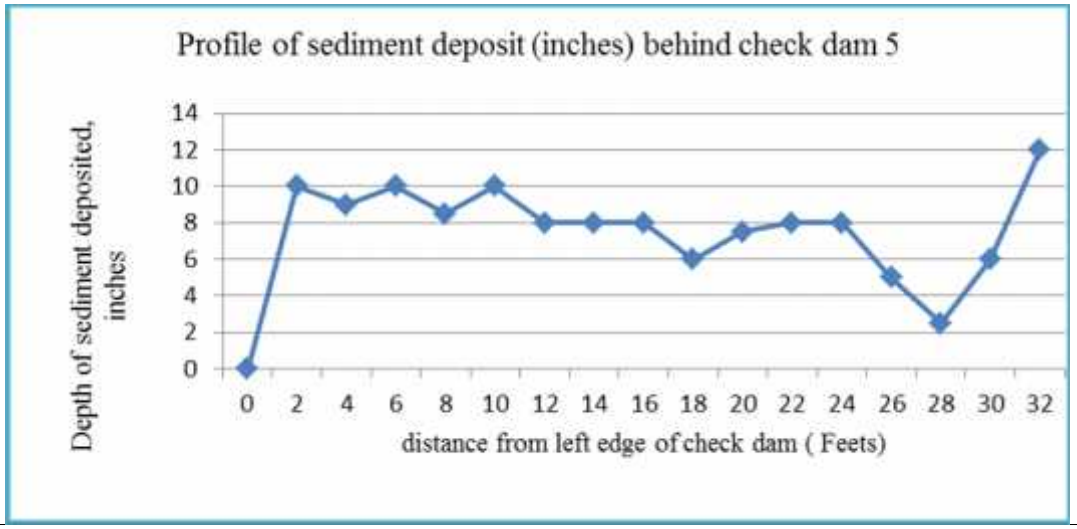
Profiles of sediment deposit behind each check dam during the year 2015


Profile of sediment deposit (inches) behind check dam 1
Depth of sediment deposited, inches
distance from left edge of check dam (Feets)


Profile of sediment deposit (inches) behind check dam 2
Depth of sediment deposited, inches
distance from left edge of check dam (Feets)


Profile of sediment deposit (inches) behind check dam 3
Depth of sediment deposited, inches
distance from left edge of check dam (Feets)


Profile of sediment deposit (inches) behind check dam 4
Depth of sediment deposited, inches
distance from left edge of check dam (Feets)


Profile of sediment deposit (inches) behind check dam 5
Depth of sediment deposited, inches
distance from left edge of check dam (Feets)

PRELIMINARY CONSCLUSION

From analysis of data collected during the year 2015 it is concluded that Rate of bed development in gullies depends upon the following factors

1. surface area of the gully exposed to rainfall
2. Rainfall Catchment area behind the gully
3. Soil type
4. Land use

THEME # 02
SOIL CONSERVATION

EXPERIMENT # 2.1	
TITLE	**ASSESSMENT OF GULLIES EXPANSION IN POTOHAR**
OBJECTIVE(S):	• To quantify the status of gully erosion and its expansion rate in Potohar. • To study the spatial and temporal variation in gully dimension under different land use and soil.types
RESEARCH WORKERS	Mr. WaqasNaseem Dr. Sultan Ahmad Rizvi Dr. Adnan Umair (SAWCRS) Mr. Muhammad Rashid (SAWCRS)
DURATION:	2015-2025
LOCATION:	Tehsils of Chakwal and KallarKahar
METHODOLOGY	➢ Selection of Gullies for assessment of erosion and expansion during 2015-16. ➢ Topographic survey with the aid of GIS/GPS/total station i. Establishment of permanent benchmarks

	ii. Delineation of gully boundaries iii. Estimation of surface area exposed to erosion iv. Length, width and depth of gullies. ➢ Catchment area ➢ Number of gullies in catchment, gully density ➢ Seasonal information regarding expansion of gullies i.e., change in length, width and depth ➢ All other information/data like Soil texture, soil Infiltration rate, soil moisture, bulk density and sediment load will be collected and analyzed in relation with soil type, rainfall intensity/duration, surface area of gully exposed to erosion, land use behind the gully and catchment area etc.to come up with the rate of gully expansion and variations in spatial and temporal terms ➢ Reporting the results
PARAMETERS	Following parameters will an accounted for the study: 1. Gullies dimensions i.e., length, width and depth 2. Land use above and within the gully 3. Catchment area feeding to gully erosion 4. Soil properties i.e., soil texture, soil moisture, soil Infiltration rate, bulk density and sediment load 5. Rainfall (intensity, depth and duration).

PREVIOUS SEASON'S RESULTS

This is first year of the project, during rabi season, sites were selected and basic parameters of gullies were recorded, one set of data is given below.

Data of Gully at Khokharbala Site for erosion/expansion

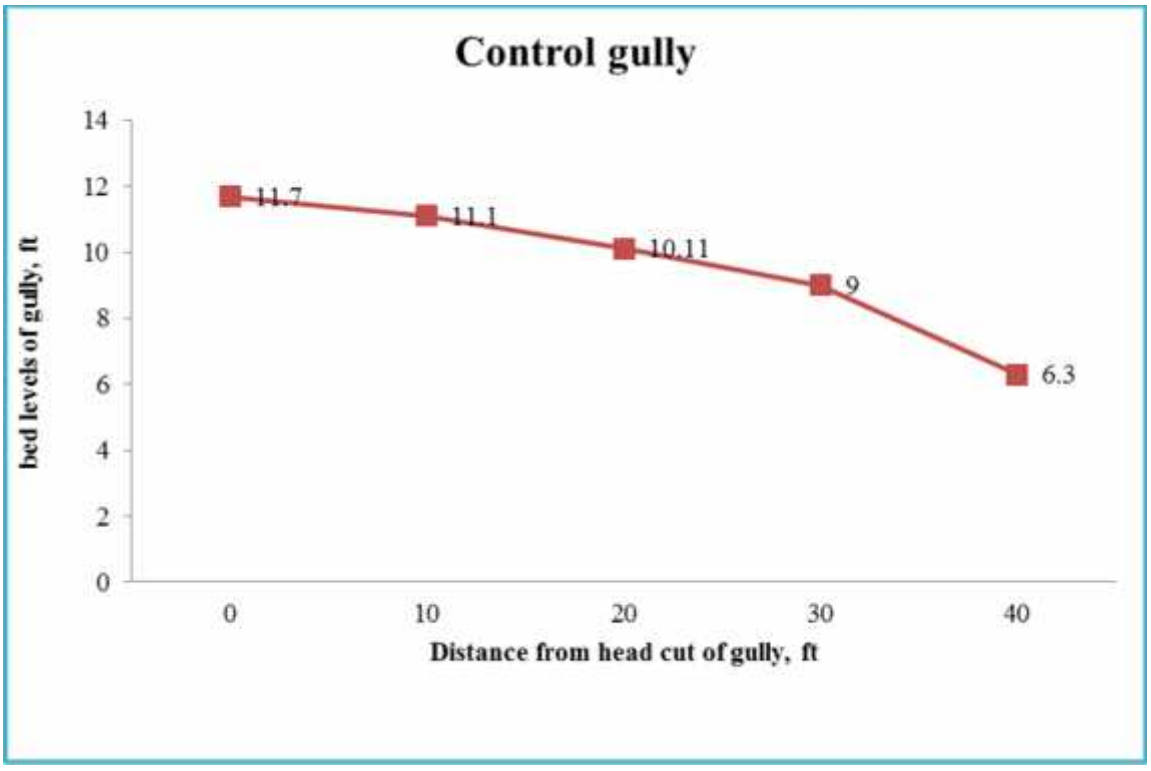
Parameters of gullies

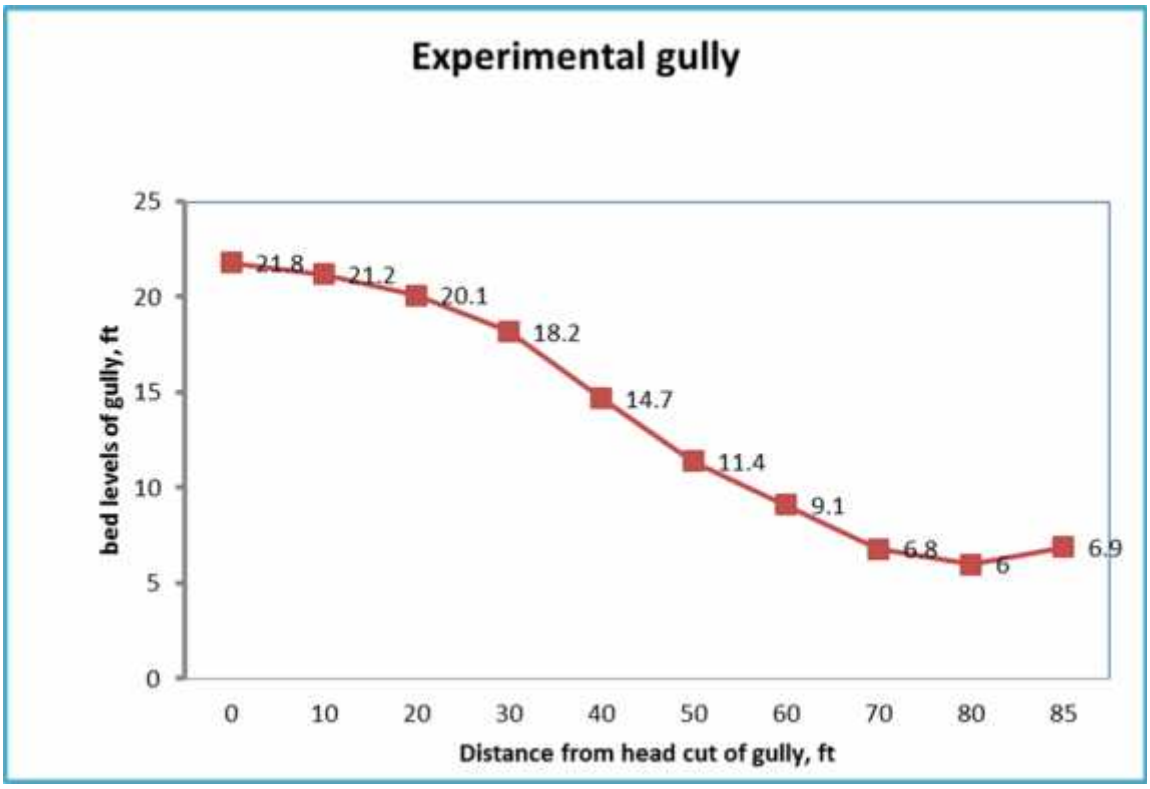
experimental gully		control gully		
Level of bench mark, feet	25	15		
parimeter of gully, feet	214	114		
length of gully, feet	85	40		

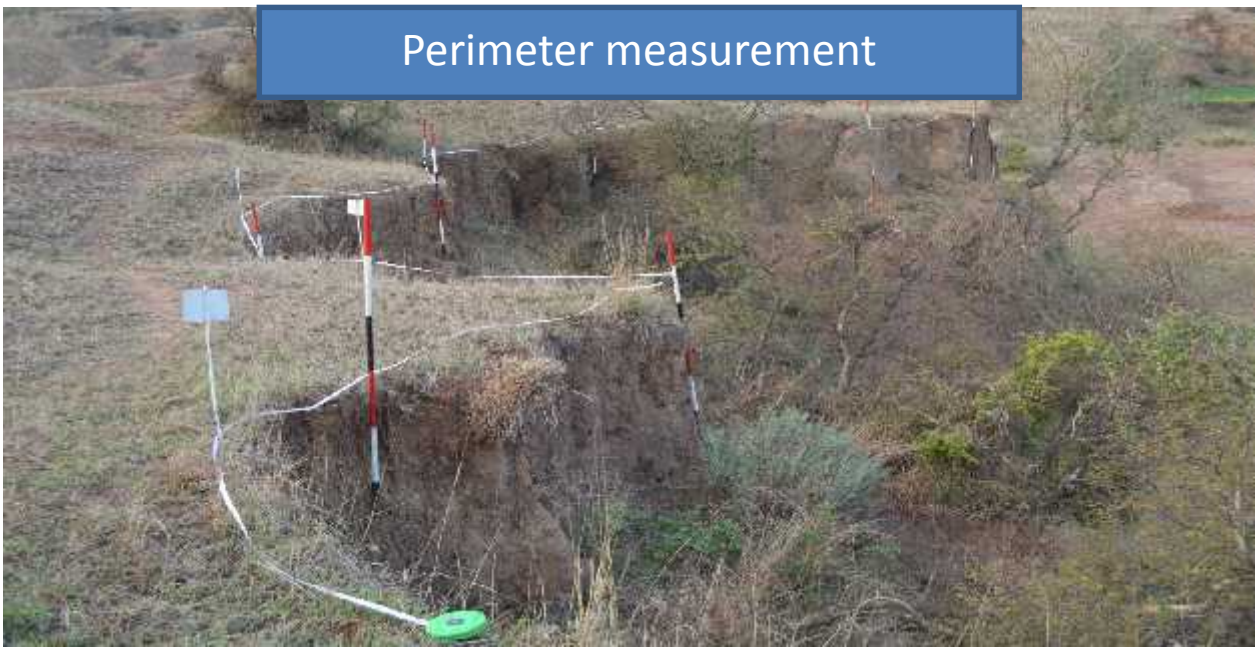
Distance ft	width, ft	reading of level	depth, ft	width, ft	reading of level	depth, ft

0	65.8	21.8	3.2	28	11.7	3.3
10	65	21.2	3.8	32	11.1	3.9
20	72	20.1	4.9	35	10.11	4.89
30	77.5	18.2	6.8	28	9	6
40	64	14.7	10.3	23	6.3	8.7
50	52	11.4	13.6			
60	45	9.1	15.9			
70	24	6.8	18.2			
80	17.7	6	19			
85	16.7	6.9	18.1			

Bed Profile of Gullies




Experimental gully
bed levels of gully, ft
25
20
15
10
5
0
21.8
21.2
20.1
18.2
14.7
11.4
9.1
6.8
6
6.9
0
10
20
30
40
50
60
70
80
85
Distance from head cut of gully, ft


Perimeter measurement


Length measurement

EXPERIMENT # 2.2	
TITLE	**EVALUATION OF EROSION CONTROL STRUCTURES INSTALLED IN CHAKWAL AREA**
OBJECTIVE	➢ To evaluate the performance of erosion control structures ➢ To assess the impact of these structures on land development and cultivation.
RESEARCH WORKERS	1. Dr. Sultan Ahmad Rizvi 2. Anwar-ul-Haq Khalid 3. Shahid Munir
DURATION:	2016-2017
METHODOLOGY	➢ Condition Survey of all loose stone structure and fields under treatment ➢ Land development and crop data will be collected ➢ Catchment area behind the treated area ➢ Rainfall events round the year ➢ Temporal and spatial comparison of land condition/development within itself and with other treatments ➢ Cost benefit of the loose stone structures, (capital and running cost) **Treatments** T1=Fields w/o Structure T2 = Fields with Structure T3 = Fields with damaged structure **Sites** S1= Rehna Sadat S2= Khonda S3= Kokharballa

	S4= ChakKhushi
PARAMETERS	➢ Capital and running cost of structure development ➢ Condition of structure ➢ Land use before and after construction of structures ➢ Soil deposition, ➢ Soil properties i.e., soil texture, soil structure, soil moisture ➢ Rainfall intensity and duration ➢ Land development and ➢ crop yield data.
PREVIOUS YEAR'S RESULTS	**New experiment**

Theme # 3
WATER CONSERVATION

EXPERIMENT # 3.1	
TITLE	**Comparison of different tillage practices for moisture conservation and improvement of wheat yield**
OBJECTIVE(S):	• To compare the efficiency of different tillage implements for moisture conservation and improvement of wheat yield

RESEARCH WORKERS	1. Muhammad Rafique Sajjad 2. Waqas Naseem 3. Dr. Abid Subhani
DURATION:	2015-2018
METHODOLOGY	T1 = Cultivator T2 = M.B. Plough T3 = Disc Plough • The implements have be used during Kharif • Wheat Crop was sown during Rabi
PARAMETERS	• Soil pHs, ECe, O.M, Av. P, Ext. K, and texture at start of study • Soil O.M after crop harvest every year • Soil moisture (0-30, 30-60 and 60-90 cm) at sowing, 03 months after sowing and at harvesting of wheat crop • Wheat grain and straw yield • Plant population No. of fertile tillers

PREVIOUS YEAR'S RESULTS

The implements were used during Kharif 2015 and now Wheat(Chakwal-50) is in field . The crop was sown during Rabi 2015-16

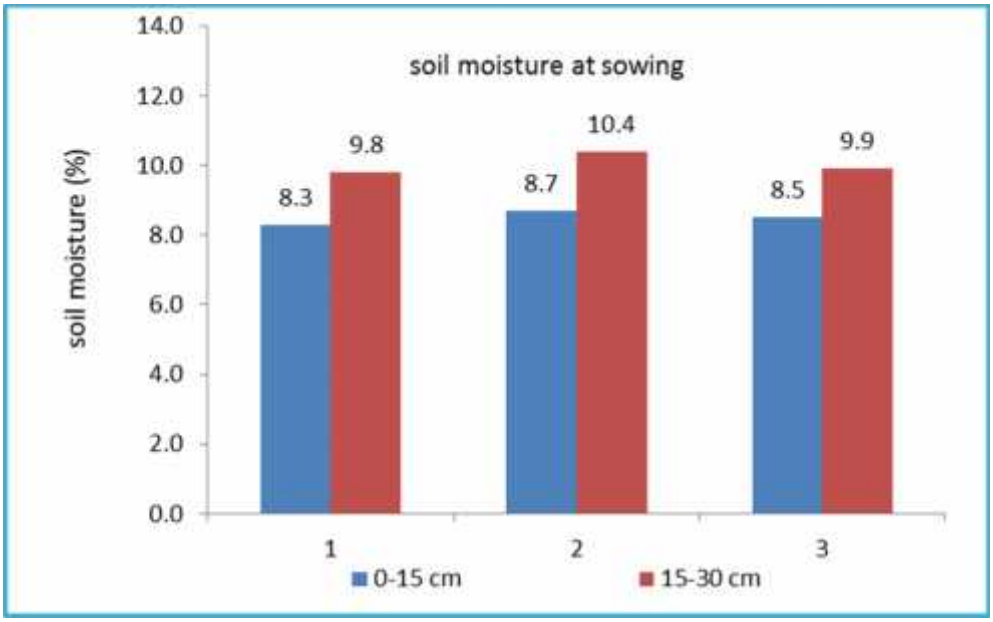
EXPERIMENT # 3.2	
TITLE	**Effect of cowpea as mulch on wheat under rainfed condition**
OBJECTIVE	To study the effect of green manure as mulch on wheat under rainfed conditions
RESEARCH WORKERS	Muhammad Rafique Sajjad Dr.Riffat Bibi Safia Naureen Malik
DURATION	2014-15 to 2016-17
LOCATION	SAWCRI Chakwal
METHODOLOGY	• Treatment

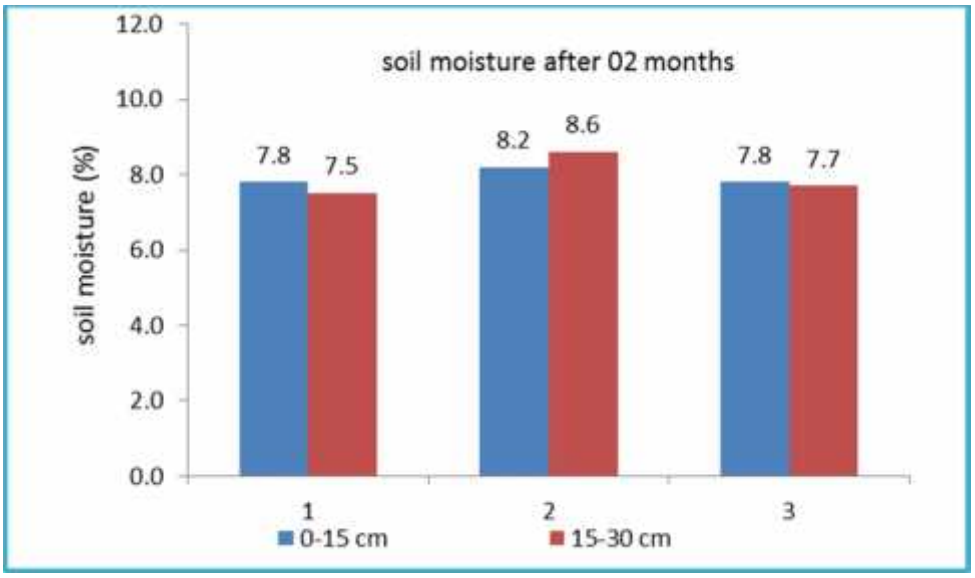
	➢ Control ➢ GM (Incorporation) ➢ GM as mulch with no till Recommended dose of fertilizer was applied in all treatments
PARAMETERS	Soil: pH, ECe, OM, Available P, Ext K, Soil Texture at start of study Soil Moisture contents at wheat sowing, after 02 months, after 04 months and at harvesting stage. Plant: Biomass yield of cowpea Grain yield of wheat Straw yield and fertile tillers of wheat.

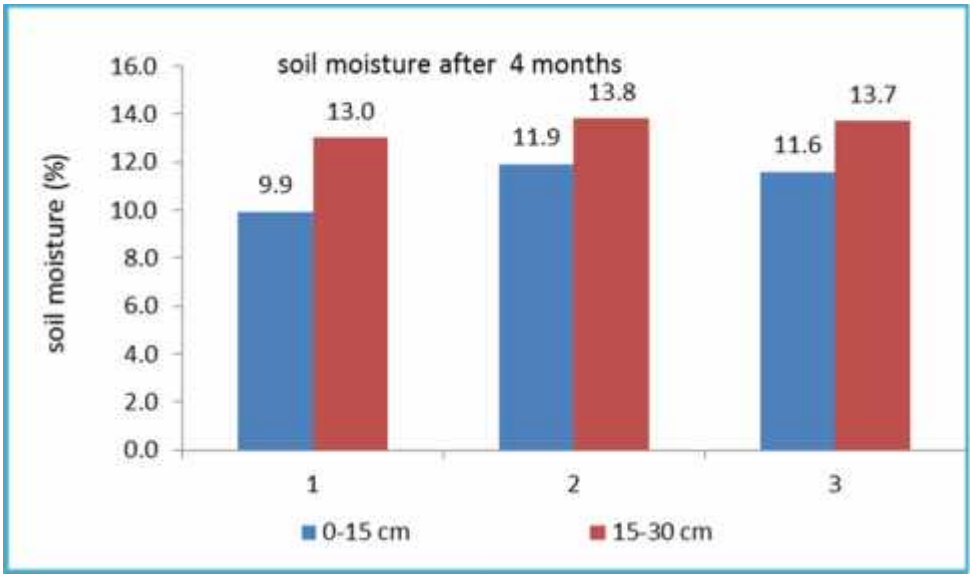
PREVIOUS YEAR RESULTS:

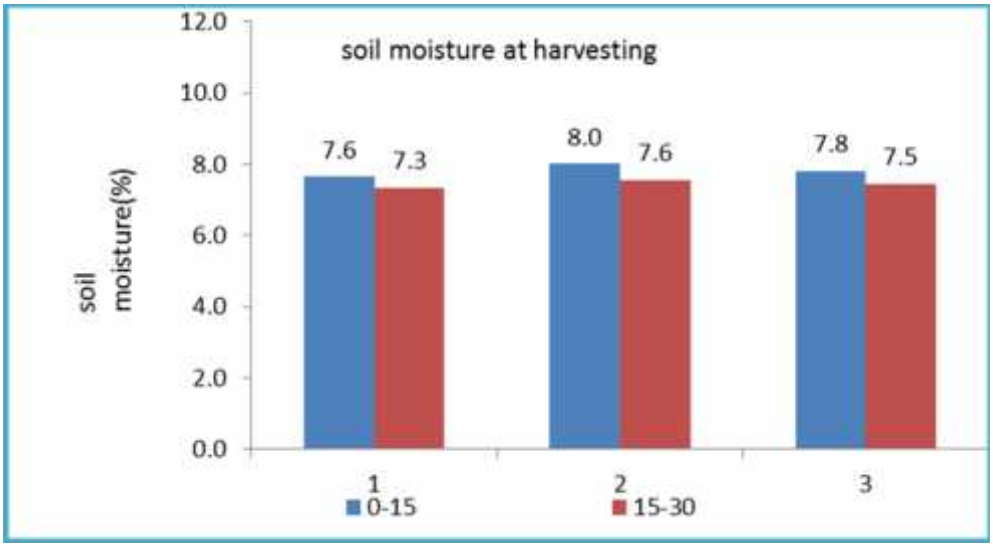
(Biomass of Cow pea)

- T1 = no green manure
- T2 = 19.14 t ha^{-1}
- T3 = 18.49 t ha^{-1}




soil moisture after 02 months
soil moisture (%)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
7.8
7.5
8.2
8.6
7.8
7.7
1
2
3
0-15 cm
15-30 cm


soil moisture after 4 months
soil moisture (%)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
9.9
13.0
11.9
13.8
11.6
13.7
1
2
3
0-15 cm
15-30 cm

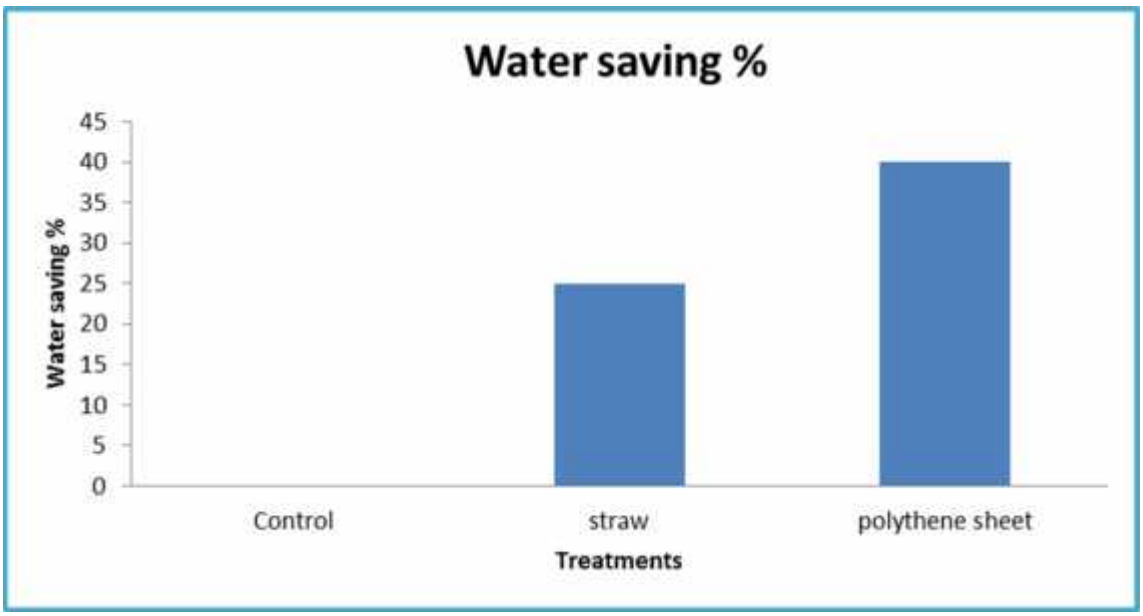

soil moisture at harvesting
soil moisture(%)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
7.6
7.3
8.0
7.6
7.8
7.5
1
2
3
0-15
15-30

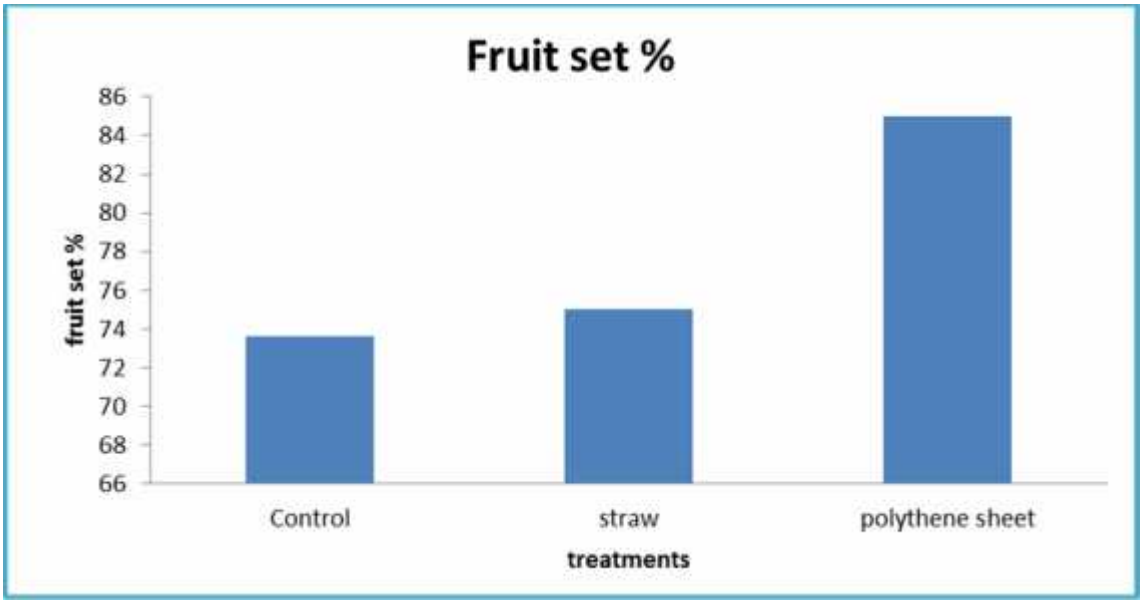
EXPERIMENT # 3.3	
TITLE	**Comparison of different amendments on soil properties and crop yield under rainfed condition**
OBJECTIVE	• To compare the efficiency of different amendments for moisture conservation and improvement of crop yield(Wheat and Mung bean) • To intensify the cropping system
RESEARCH WORKERS	Dr. Riffat Bibi Waqas Naseem M.Rafique Sajjad Dr. Abid Subhani Safia Naureen Malik
DURATION	2016-2019
LOCATION	SAWCRI Chakwal
METHODOLOGY	• Treatments ➢ T1 = Recommended NPK ➢ T2 = 25% FYM (Based on N)+75% N(PK) ➢ T3 = 25% Compost(Based on N) +75% N(PK) ➢ T4 = 50 %Compost(Based on N) +50% N(PK) ➢ T5= 50 %FYM(Based on N) +50% N(PK) Mung bean crop will be sown during Kharif and Wheat Crop will be sown during Rabi season.
PARAMETERS	• Soil physical and chemical properties(Texture, pHs, ECe, O.M, Av. P, Ext. K,) will be analyzed before and after harvest of crops. • Soil samples for moisture analysis will be collected fortnightly Wheat and Mung bean yield.
PREVIOUS YEAR'S RESULTS	New Experiment

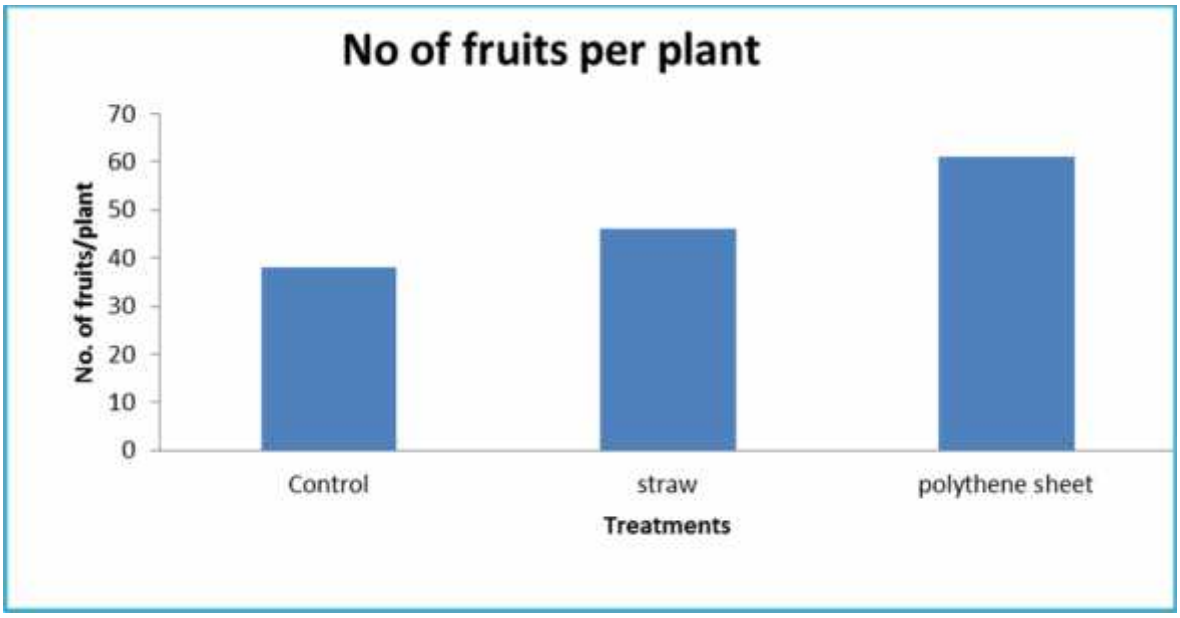
Theme # 4
Water Productivity

EXPERIMENT 4.1	
TITLE	**Evaluation of different mulches to enhance the water productivity of stored rainwater**
OBJECTIVE	To enhance water use efficiency
RESEARCH WORKERS	1. Safia Naureen Malik 2. Dr. Riffat Bibi
DURATION	2015-2017
LOCATION	Farmer field Wallana District Chakwal
METHODOLOGY	**Treatments** • Control (1 bed) • Plastic mulch (2 beds) • Straw mulch (2 beds)
PARAMETERS	• Soil moisture %, • Crop yield parameters

PREVIOUS YEAR'S RESULTS


Water saving %
Water saving %
45
40
35
30
25
20
15
10
5
0
Control
straw
polythene sheet
Treatments


Fruit set %
fruit set %
86
84
82
80
78
76
74
72
70
68
66
Control
straw
polythene sheet
treatments



EXPERIMENT # 4.2	
TITLE	**Efficiency of different mulches to enhance water productivity in citrus orchard**
OBJECTIVE	The objective of this study was to investigate the effect of inorganic and organic mulches on the yield components of citrus and to compare efficacy of inorganic and organic mulches
RESEARCH WORKERS	1. Safia Naureen Malik 2. Waqas Naseem 3. Dr. Riffat bibi 4. Dr. Abid Subhani
DURATION	2016-2019
LOCATION	SAWCRI Chakwal
METHODOLOGY	**Treatments** • T1= Control/Without mulch • T2 =transparent plastic sheet inorganic mulches • T3 =Black plastic sheet

	• T4=lawn grass • T5=dry grasses/ local vegetation organic mulches Recommended fertilizer inputs will be applied. Mulches will be installed in such a way to intercept maximum rain water. Supplementary irrigations will be applied in equal volume (L) to all plants on appearance of wilting symptoms.
PARAMETERS	• Soil moisture (fortnightly) depth: 0-15, 15-30, 30-60, 60-90cm • O.M (%) • Water Productivity • Fruit yield
PREVIOUS YEAR'S RESULTS	**New Experiment**

SOIL & WATER CONSERVATION RESEARCH STATION, FATEHJANG

THEME # 1

SOIL AND WATER LOSSES MONITORING

EXPERIMENT#1.1

TITLE **LOSS OF SOIL NUTRIENTS AT DIFFERENT SLOPE GRADIENTS UNDER DIFFERENT CROP COVERS AND SOIL AMMENDMENTS**

OBJECTIVES

1. Quantification of runoff water and sediment loss at different slope gradients

2. Quantification of soil nutrients loss through run off of rain water against different soil amendments and crop covers at different slope gradients

RESEARCH WORKER (S): 1. Mrs. Rahina Kausar (PI)

2. Mr. Muhammad Rashid
3. Dr Obaid ur Rehman

DURATION 2013-2018

LOCATION Soil and Water Conservation Research Station, Fateh Jang

METHODOLOGY

Layout of Experiment

1% Slope				5% Slope				10% Slope			
Control	Chemical Fertilizer	Compost	Gypsum	Control	Chemical Fertilizer	Compost	Gypsum	Control	Chemical Fertilizer	Compost	Gypsum
Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut	Ground nut

- Recommended rates of chemical fertilizer and compost were used
- Ground nut was sown in Kharif seasons

Runoff and soil loss was measured by using the standard runoff/erosion plots as described by Morgan (1996). The plot edges/borders were made of solid materials. The edges of the runoff plots were about 10 cm above the soil surface to prevent input from splashes entering the plot from the surrounding areas and were sufficiently embedded in the soil so the plot would not be shifted by alternate wetting and drying of the soil. Runoff and eroded sediments were channeled into the collecting tanks. Each runoff plot was 2 m in width and 5 m in length. Collected run off was measured for runoff

and sediment yield after every rainfall > 20 mm. A sample of 200 ml was taken from the tank after thorough mixing to bring all the sediments into suspension. The sample was taken to the laboratory where the sediments were filtered, oven-dried at 105 ^{0}C and weighed and were analyzed for NPK and micronutrients (Zn, Fe, Mn and Cu).

Rainfall Measurement

Rainfall was measured at each catchment with

Rain gauge

RESULTS

Soil Status at the start of experiment

pH	7.81
Bulk density	1.62 g cm^{-3}
O.M	0.81 %
EC_e	0.76 dS m^{-1}
P	5.0 mg Kg^{-1}
K	80 mg Kg^{-1}
Soil Texture	Sandy loam

Topography and soil amendment effect on soil sediment yield (t ha^{-1})

No. of storms>20mm	Rainfall (mm)	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum
10	563	1	1.56	1.10	0.84	0.76
		5	1.94	1.75	1.00	0.85
		10	3.12	2.88	1.86	1.08

Topography and soil amendment effect on water runoff (m^3 ha^{-1})

No. of storms>20mm	Rainfall (mm)	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum
10	563	1	224.16	166.21	138.53	110.12
		5	294.20	200.37	186.28	158.50
		10	323.10	302.80	274.30	210.30

Topography and soil amendment effect wheat grain yield (Kg ha^{-1})

No. of storms>20mm	Rainfall (mm)	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum
10	563	1	2120	2823	2620	2643
		5	1680	2467	2476	2460
		10	1456	2100	2122	2140

No. of storms>20mm	Rainfall (mm)	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum
10	563	1	2702	3573	3313	3367
		5	2141	3126	2148	3122
		10	1854	2658	2679	2717

Topography and soil amendment effect on wheat straw yield (Kg ha^{-1})

Topography and soil amendment effect on soil macronutrient loss (Kg ha^{-1})

Slope Gradients (%)	Control			Chemical Fertilizer			Compost			Gypsum		
	N	P	K	N	P	K	N	P	K	N	P	K
1	0.19	0.11	1.1	1.00	0.62	5.5	0.38	0.33	4.8	0.30	0.22	4.0
5	0.27	0.14	1.7	1.56	0.70	6.2	0.66	0.42	5.1	0.46	0.30	4.5

10	0.44	0.21	2.2	2.00	0.98	9.3	0.76	0.73	7.0	0.68	0.44	5.1

Topography and soil amendment effect on soil micronutrient loss (Kg ha^{-1})

Slope Gradients (%)	Control				Chemical Fertilizer				Compost				Gypsum			
	Zn	Cu	Mn	Fe	Zn	Cu	Mn	Fe	Zn	Cu	Mn	Fe	Zn	Cu	Mn	Fe
1	0.03	0.12	0.02	0.19	0.16	0.40	0.18	0.48	0.10	0.30	0.12	0.33	0.10	0.22	0.10	0.30
5	0.09	0.21	0.10	0.27	0.40	0.55	0.21	0.55	0.16	0.51	0.17	0.45	0.14	0.31	0.20	0.41
10	0.16	0.33	0.13	0.31	0.52	0.61	0.36	0.74	0.32	0.58	0.21	0.52	0.18	0.40	0.26	0.52

THEME # 2
SOIL CONSERVATION

EXPERIMENT#2.1

TITLE — **SELECTION OF EFFECTIVE LIVE BARRIER GRASSES SPECIES FOR CONTROLLING SOIL AND WATER EROSION AND THEIR IMPACT ON SOCIO-ECONOMIC CONDITION OF THE FARMERS**

OBJECTIVE (S) — Screening of grasses under natural conditions for providing vegetative cover, palatability to livestock and biomass production

RESEARCH WORKERS
1. Mrs. Rahina Kausar (PI)
2. Mr. Muhammad Imran Akram
3. Dr. Obaid ur Rehman

DURATION — 2013-2018

LOCATION — Fateh Jang, Attock

METHODOLOGY — Various grasses, which can tolerate moisture stress and can adopt the climate, were tested for suitability. The grasses species were selected on the basis of their economic contribution and use. The promising species will be tested for vegetative

structures, watts and bunds and their palatability to livestock and other suitable uses

Grasses Species

Paltosa, Vetiver, Panicum, Canckrus,

Observations and data collection

Observations on biomass, survival habits, spreading ability, height and economic use were assessed.

RESULTS

Physico-chemical analysis of selected site

Parameter	Value	Unit
pH	7.96	-
Bulk density	1.61	g cm^{-3}
O.M	0.77	%
EC_e	1.08	dS m^{-1}
P_2O_5	4.9	mg Kg^{-1}
K_2O	87	mg Kg^{-1}

Parameters of grasses recorded

Sr. #	Name	Plant Height (cm)	Plant Periphery (cm)	Biomass (t ha^{-1})
1	Paltosa	94	91	1.66
2	Vetiver	198	105	3.12
3	Panicum	146	94	2.00

4	Canckrus	90	51	2.10
LSD		**31.21**	**23.25**	**1.27**

EXPERIMENT#2.2

TITLE **CLIMATE CHANGE AND FOOD SECURITY: SOIL IMPROVEMENT WITH CROP RESIDUE MANAGEMENT**

OBJECTIVE (S) To assess the potentials of crop residue incorporation in soil for carbon sequestration

To evaluate the impact of crop residue addition soil physical, chemical and hydrological properties and on crop productivity

RESEARCH WORKERS
1. Mr. Muhammad Imran Akram (PI)
2. Mr. Muhammad Rashid
3. Dr. Obaid ur Rehman

DURATION 2014-2019

LOCATION Fateh Jang

METHODOLOGY

Treatments

Tr.	Crop Residue input (%)	Fertilizer Inputs
T_1	0	Rec. NPK 100%
T_2	25	Rec. NPK 50%
T_3	50	Rec. NPK 50%
T_4	100	Rec. NPK 50%
T_5	100	Rec. NPK 25%

Layout and designing

Experiment will be conducted in Mungbean-Wheat cropping

sequence in RCBD arrangement

Measurements

Soil physical Properties

Bulk Density (Core method)

Aggregate Stability (Wet Sieving)

Infiltration Rate

Saturated Hydraulic Conductivity

Soil Chemical Properties

pH, SOM and NPK

Crop Yield

Grain & Straw yield

RESULTS

Basic soil analysis

Treat.	Soil Depth	pH	EC (d Sm^{-1})	K (mg Kg^{-1})	P (mg Kg^{-1})	O.M (%)	Moisture (%)
T_1	0-6	7.58	0.98	60	2.9	0.80	4.90
	6-12	7.46	0.75	80	2.9	0.81	5.69
T_2	0-6	7.70	0.61	100	2.5	0.78	4.96
	6-12	7.69	0.76	80	3.1	0.80	5.89
T_3	0-6	7.76	0.87	80	3.2	0.79	4.81
	6-12	7.70	0.89	60	2.8	0.80	5.76
T_4	0-6	7.61	0.88	80	3.0	0.77	5.10

	6-12	7.56	0.83	70	2.8	0.76	4.87
T_5	0-6	7.78	0.79	95	3.2	0.80	5.00
	6-12	7.72	0.71	90	2.9	0.77	4.88

Effect of crop residue incorporation on wheat

Treatments/CS	**Grain yield (Kg ha^{-1})**	**Straw yield (Kg ha^{-1})**
T1 (WM) CR0 &NPK100	1711 b	2678 e
T2 (WM) CtR25 &NPK 50	1766 b	3716 a
T3 (WM)t CR50&NPK50	1971 ab	3389 c
T4 (WM) CR100 &tNPK50	2332 a	3549 b
T5 (WM) CR100 &NPK 25	1813 b	3328 d
T1 (WF) CR0 &NPK100	1624 c	2212 d
T2 (WF) CR25 &NPK 50	1843 bc	2424 cd
T3 (WF) CR50&NPK50	2123 ab	2773 b
T4 (WF) CR100 &NPK50	2209 a	3765 a
T5 (WF) CR100 &NPK 25	2110 ab	2537 bc
T1 (MF) CR0 &NPK100	0	0
T2 (MF) CR25 &NPK 50	0	0
T3 (MF) CR50&NPK50	0	0
T4 (MF) CR100 &NPK50	0	0
T5 (MF) CR100 &NPK 25	0	0
LSD for WM = 17.34	**LSD for WF =267.4**	

Effect of crop residue incorporation on soil properties

Treatments	Infiltration rate (inches min^{-1})	Bulk density (g cm^{-3})	O.M (%)
T_1 CR0 &NPK100	13	1.62	0.89
T_2 CR25 &NPK 50	12	1.58	0.89
T_3 CR50&NPK50	11	1.58	0.88
T_4 CR100 &NPK50	10	1.52	0.92
T_5 CR100 &NPK 25	11	1.57	0.91

EXPERIMENT # 2.3

TITLE **IMPACT OF LAND USE INTENSITY AND TYPE ON SOIL PROPERTIES: OPPORTUNITIES AND IMPLICATIONS**

OBJECTIVE
1. Land use impact on soil fertility and soil properties
2. Land use impact on soil quality (physical properties)
3. Role of land use on soil spatial variability

RESEARCHERS
1. Mr. Muhammad Rashid (PI)
2. Mr. Muhammad Imran Akram
3. Dr. Obaid ur Rehman

DURATION 2014-2020

LOCATION Fateh Jang Areas

METHODOLOGY **Treatments/Cropping System**

- Cereal – Fallow
- Cereal – Legume
- Legume – Fallow
- Orchard Trees

Observations

Inputs data

Income data

Soil Sampling

3 plots under each cropping system will be selected and 3 soil samples consisting of 3 sub-samples will be collected at the depth of (0-15 & 15-30 cm) at 3 stages of crop growth stages (at sowing, middle and at harvest)

Soil Analyses

- Chemical Characteristics
- (pH, EC, P, K, O.M)
- Physical Characteristics
- (Water holding capacity, Bulk density, Porosity)

Rainfall Measurement

Rainfall will noted for each sampling sites

RESULTS

Soil Analysis at BARS

Treatments	**Depth (cm)**	**pH**	**EC (d Sm^{-1})**	**P_2O_5 (mg Kg^{-1})**	**K_2O (mg Kg^{-1})**	**O.M (%)**	**Moisture (%)**
CF	0-15	7.50	1.11	3.11	60	0.78	4.96
	15-30	7.65	1.09	3.40	80	0.63	5.78
	30-60	7.53	0.98	3.30	80	0.84	5.01
CL	0-15	7.76	1.43	3.40	60	0.83	5.46
	15-30	7.85	1.14	2.90	80	0.67	5.01
	30-60	7.76	1.43	3.40	60	0.83	5.46
LF	0-15	7.76	1.27	2.70	80	0.87	4.11

	15-30	7.64	1.05	3.70	60	0.82	6.11
	30-60	7.85	1.14	2.90	80	0.67	5.01
	0-15	7.80	1.11	2.90	80	0.70	5.35
OT	15-30	7.91	1.10	3.80	80	0.90	5.10
	30-60	7.87	1.19	5.60	60	0.66	6.80

Soil Analysis at Muqam

Treatments	**Depth (cm)**	**pH**	**EC (d Sm^{-1})**	**P_2O_5 (mg Kg^{-1})**	**K_2O (mg Kg^{-1})**	**O.M (%)**	**Moisture (%)**
	0-15	7.54	1.09	3.73	80	0.76	4.16
CF	15-30	7.69	1.07	3.64	100	0.81	6.38
	30-60	7.56	1.05	3.46	100	0.86	7.52
	0-15	7.62	1.07	5.60	60	0.46	4.91
CL	15-30	7.86	1.20	3.78	60	0.67	6.85
	30-60	7.88	1.02	3.58	60	0.86	8.75
	0-15	7.65	1.22	3.90	60	0.61	4.16
LF	15-30	7.73	1.09	5.70	80	0.58	6.18
	30-60	7.99	1.11	5.44	100	0.67	8.69
	0-15	7.93	1.20	6.41	80	0.48	4.16
OT	15-30	7.89	1.16	4.62	60	0.76	4.41
	30-60	7.97	1.28	6.80	60	0.67	7.52

Soil Analysis at Pind Sultani

Treatments	**Depth (cm)**	**pH**	**EC (d Sm^{-1})**	**P_2O_5 (mg Kg^{-1})**	**K_2O (mg Kg^{-1})**	**O.M (%)**	**Moisture (%)**
CF	0-15	7.78	0.46	2.90	60	0.72	3.95

	15-30	7.79	0.41	3.00	70	0.80	4.16
	30-60	7.81	0.58	3.33	64	0.81	5.01
CL	0-15	7.77	0.51	2.74	77	0.57	3.86
	15-30	7.81	0.42	2.91	83	0.65	7.16
	30-60	7.87	0.46	3.10	88	0.69	5.01
LF	0-15	7.63	0.47	3.13	75	0.78	3.91
	15-30	7.67	0.54	3.45	77	0.71	4.28
	30-60	7.86	0.66	3.36	80	0.81	5.10
OT	0-15	7.63	0.48	3.40	84	0.69	3.86
	15-30	7.74	0.61	3.36	76	0.72	1.01
	30-60	7.81	0.81	3.90	70	0.54	5.75

EXPERIMENT # 2.4

TITLE

IMPACT OF TILLAGE AND CROP MANAGEMENT ON SOIL ORGANIC CARBON POOLS AND PHYSICAL ENVIRONMENT TO ACQUIRE CLIMATE CHANGE RESILIENCE

OBJECTIVE (s)

1. To determine the impact of different tillage operations on soil organic carbon
2. To determine the impact of different tillage operations on soil physical characteristics
3. To determine the impact of different tillage operations on crop yield and yield attributes

RESEARCHERS

1. Mr. Muhammad Rashid (P.I)
2. Mrs. Rahina Kausar
3. Dr Obaid ur Rehman

DURATION 2015 to 2020

LOCATION Fateh Jang

METHODOLOGY **Treatments**

T_1 Control/No Tillage

T_2 Shallow Tillage (Cultivator, 4-6 Inches)

T_3 Deep tillage (Moldboard Plough, 8-10 Inches)

The experiment will be conducted in wheat-fallow and wheat-green manuring cropping sequences

Measurements

Soil reaction (At harvest)

Organic carbon (At harvest)

Bulk density (At harvest)

Porosity (At harvest)

Infiltration rate (At harvest)

Soil saturation percentage (At harvest)

Soil moisture contents (30 days interval)

Wheat yield and yield parameters

RESULTS New Trial

THEME # 3

WATER CONSERVATION

EXPERIMENT # 3.1

TITLE	**POTENTIALS AND PROSPECTS OF HYDROGELS FOR SOIL MOISTURE CONSERVATION UNDER RAINFED CONDITIONS**
OBJECTIVE	To study the effect of Hydrogels application for soil moisture conservation and its impact on citrus growth
RESEARCHERS	1. Mr. Muhammad Rashid (P.I) 2. Mrs. Rahina Kausar 3. Dr Obaid ur Rehman
DURATION	2010 to 2016
LOCATION	Farmer Fields at *Muqaam* (Fateh Jang)

METHODOLOGY

Treatments

T_1 Control (Untreated)

T_2 Qemisoyl @ 100g plant^{-1}

T_3 Soil Magic @ 100g plant^{-1}

- Recommended dose of hydrogels were mixed into the soil under the canopy area of all selected five plants up to depth of 60cm.
- Recommended fertilizers were added @ 500-250-250 NPK per plant respectively.

Soil analysis:

ECe, pH, Bulk density, O.M, before application of Hydrogels and periodical soil moisture contents (%) were recorded before application of Hydrogels and at interval of one month up to the depth of 60 cm after application of Hydrogels.

Parameters

- Plant height and Periphery
- Number of fruits per plant

RESULTS

Soil Analysis before Application of Hydrogels

Parameter	**Value**	**Unit**
pH	8.1	**-**
O.M	0.91	%
EC_e	0.8	dS m^{-1}
P_2O_5	4.10	mg Kg^{-1}
K_2O	84	mg Kg^{-1}
Soil Texture	Sandy loam	-

Periodical moisture contents (30 days interval) after hydrogel application

Date	**Depth (cm)**	**Control**	**Qemisoyl**	**Soil Magic**
		Mean (5 Plants)	**Mean(5 Plants)**	**Mean(5 Plants)**
1.10.14	0-15	7.02	8.70	8.11
	15-30	7.22	9.00	8.47
	30-45	7.43	9.12	8.61
	45-60	7.66	9.36	8.94
1.11.14	0-15	6.94	7.86	7.55
	15-30	7.10	8.04	7.61
	30-45	7.33	8.21	7.87
	45-60	7.63	8.68	8.00
1.12.14	0-15	7.33	8.55	8.53
	15-30	7.56	8.74	8.61

	30-45	7.63	8.85	8.70
	45-60	7.87	9.03	8.81
1.1.15	0-15	8.22	11.22	10.50
	15-30	8.41	11.54	10.62
	30-45	8.55	11.70	10.74
	45-60	8.63	11.81	11.02
1.2.15	0-15	9.00	14.00	13.02
	15-30	9.01	14.32	13.34
	30-45	9.33	14.65	13.68
	45-60	9.56	14.84	13.84
1.3.15	0-15	8.81	14.20	13.33
	15-30	8.96	14.00	13.56
	30-45	9.12	14.12	13.68
	45-60	9.31	14.40	13.80

Effect of Hydrogels on citrus plants

Sr. No	Treatments	Fruit plant	# Plants	Av. Plant height (m)	Avg. plant canopy (m)	No. Fruit Plant^{-1}
1	Control	Blood Red	5	3.41	10.65	190.33 b
2	Qemisoyl	Blood Red	5	3.79	11.48	265.33 a
3	Soil Magic	Blood Red	5	3.61	12.85	232.33 ab
LSD				**0.73**	**2.92**	**64.28**

EXPERIMENT # 3.2

TITLE	**FATE OF PHOSPHATIC FERTILIZERS UNDER DIFFERENT RAINFALL REGIMES OF THE RAINFED REGION**
OBJECTIVE (S)	Fate of different phosphatic fertilizers sources under different moisture and rainfall regimes and their FUE
RESEARCH WORKERS	1. Mr. Muhammad Imran Akram (PI) 2. Mr. Muhammad Rashid 3. Dr. Obaid ur Rehman
DURATION	2013-2018
LOCATION	• High Rainfall Zone • Medium Rainfall Zone • Low Rainfall Zone

METHODOLOGY

Treatments

T_1	**Control**
T_2	**SSP**
T_3	**DAP**
T_4	**Nitrophos**

All the fertilizer nutrients were applied as basal dose while the recommended rates of nitrogen were supplemented by urea.

Rainfall Measurement

Rainfall was measured during the growing season on monthly basis at all the study locations.

Soil Analysis

Soil samples were collected and analyzed for:

i. Saturation % (Before sowing)
ii. OM (Before sowing)
iii. P (at 1 month interval)

Crop Parameters

i. Straw yield (Kg ha^{-1})
ii. Grain yield (Kg ha^{-1})

Fertilizer Use Efficiency

Fertilizer use efficiency for each crop under each rainfall zone will be calculated:

Cost of Fertilizer Applied / Cost of Crop Output X 100

PREVIOUS YEAR/S RESULTS

Soil analysis at the start of experiment

Parameter	High rainfall zone	Medium rainfall zone	Low rainfall zone
pH	7.81	7.72	7.69
Saturation %	18	16	16
O.M (%)	0.90	0.82	0.78
P_2O_5 (mg Kg^{-1})	4.3	3.4	4.1

Effect of P sources on Wheat grain yield (Kg ha^{-1}) at different rainfall regimes

Treatments	High Rainfall	Medium Rainfall	Low Rainfall	Mean
Control	1560	1466	1280	**1435 b**
DAP	2105	1987	1473	**1855 a**
SSP	1922	1898	1376	**1732 a**
NP	1965	1922	1458	**1782 a**
Mean	**1888 a**	**1818 a**	**1397 b**	
LSD		89.6		

Effect of P sources on wheat straw yield (Kg ha^{-1}) at different rainfall regimes

Treatments	High Rainfall	Medium Rainfall	Low Rainfall	Mean
Control	2105	2223	1600	**1976 c**
DAP	2580	2987	1780	**2449 a**
SSP	2437	2753	1690	**2294 b**
NP	2513	2868	1794	**2392 a**
Mean	**2409 b**	**2708 a**	**1716 c**	

Effect of P sources on soil available P at different rainfall regime

Treatments	Low Rainfall Zone				Medium rainfall Zone				High Rainfall Zone			
	Pre Sow	30 DAS	60 DAS	Post Har	Pre Sow	30 DAS	60 DAS	Post Har	Pre Sow	30 DAS	60 DAS	Post Har
Control	3.4	3.2	3.1	3.0	4.0	3.9	3.7	3.6	4.3	4.3	4.1	4.0
DAP	3.9	3.8	3.8	3.6	4.0	4.4	4.9	4.8	4.4	4.9	5.2	5.1
SSP	3.5	3.2	3.3	3.0	3.6	3.3	3.7	3.7	4.3	4.4	4.3	4.4
NP	3.7	3.5	3.4	3.2	3.6	4.2	4.5	4.4	4.3	4.6	4.8	4.6

Effect of P sources on soil saturation % at different rainfall regimes at harvest

Treatments	High rainfall zone	Medium rainfall zone	Low rainfall zone
Control	23	21	19
DAP	28	25	23
SSP	24	22	20
NP	25	23	21

Effect of P sources on soil O.M % at different rainfall regimes at harvest

Treatments	High rainfall zone	Medium rainfall zone	Low rainfall zone

Control	0.79	0.72	0.70
DAP	0.88	0.81	0.78
SSP	0.81	0.76	0.72
NP	0.83	0.78	0.74

THEME # 4

WATER PRODUCTIVITY

EXPERIMENT # 4.1

TITLE — **HIGH EFFICIENCY IRRIGATION TECHNIQUES FOR ORCHARD TREES FOR SLOPPY LANDS**

OBJECTIVE
- To enhance water use efficiency
- To enhance fertilizer use efficiency

RESEARCHERS
1. Muhammad Imran Akram (P.I)
2. Mr. Muhammad Rashid
3. Dr Obaid ur Rehman

DURATION — 2015 to 2020

LOCATION — BARS Fateh Jang

METHODOLOGY — **Treatments**

1. Pitcher irrigation (5 L Capacity Clay Pitcher)
2. Perforated plastic sleeve irrigation (3/ dia plastic pipe up to feet depth with 10 holes of 10mm)
3. Bottle irrigation (Drink bottles with multiple hole of 10 mm dia)

4. Basin irrigation
5. Surface drip irrigation

Measurements

1. Soil moisture contents (at interval of 1 month)
2. Organic matter content
3. NPK
4. Fruit tree yield parameters
5. Water Productivity

New Trial

RESULTS

THEME # 1 **SOIL CONSERVATION**

EXPERIMENT # 1.1 **EVALUATING THE FARM RUNOFF STRUCTURES FOR WATER HARVESTING AND SOIL CONSERVATION AT FARMER FIELD LEVEL IN HIGH RAINFALL AREA**

Objective	Participatory evaluation of the performance of farm runoff structures at farmers fields for damage reduction and farm runoff management
Research worker	Dr. Adnan Umair, & Agricultural Chemist

Duration: Continuous

Location: Khabbal, Jermot, Khallabutt, Dhoke Mian Jewan, Mohra viru, Ladder, Sakhra, Bhit Sher Ali, Hafial

Methodology: Peak discharge of water to be passed was calculated by using rational formula Q = CIA where Q is discharge, C is the coefficient which is taken as 0.4 for medium as 4 inches per hour (highest possible in the area) and A is area in acre. In this way the form of equation will be Q = 1.6 A. Type of structures was designed on the basis of peak discharge of water, fall type of soil..

Observation & data collection: The observations include the rainfall, runoff to be passed, and runoff marks, in addition to the data on structures performance.

The performance will be observed by recording:

6. Displacement of stones
7. Settlement of stones due to undermining or surface soil loss.
8. Erosion/gully development at down stream and up stream of the structures.
9. Yield of crop (what ever the farmer sows in field **with-structure**) in upper field in relation to control (what ever the farmer sows in the field **without- structure.**

Quantitative assessment

iv. Estimation of Soil Moisture: Soil moisture will be recorded up to the depth 120 cm in fields with structure and without structures (Control).

v. Soil Erosion Estimation: Soil loss will be estimated as a result of erosion through measuring the size of gullies etc.

vi. Crop Yield: Millet will be sown at all sites with following treatments and yield will be recorded.

- Farmer's practice in field with structure.
- Farmer's practice in field without structures (Control).
- Recommended practice in field with structure.
- Recommended practice in field without structure (Control

Previous Year's Results/Accomplishments:

Table-1: Soil water content (%) in soil before sowing of Wheat.

Str.#	Site	Depths (cm)	Recommended dose with Structure	FP with Structure	Recommended dose without Structure	FP without Structure

1	Khabbal	0-15	8.6	8.4	8.6	8.5
		15-30	8.6	8.4	8.6	8.4
		30-60	8.4	8.3	8.4	8.2
		60-90	8.3	8.2	8.4	7.9
6	Ladder	0-15	8.6	8.4	8.6	8.5
		15-30	8.6	8.4	8.6	8.5
		30-60	8.4	8.2	8.4	8.3
		60-90	8.4	8.0	8.4	8.1
12	Jermot	0-15	8.8	8.4	8.7	8.4
		15-30	8.7	8.4	8.7	8.3
		30-60	8.5	8.3	8.6	8.3
		60-90	8.3	8.2	8.5	8.2

Table-2: Height of water passed over the crest

Sites	Height of water passed over the crest	Rainfall (mm)
Khabbal	6.3 to 12 cm	103.5
Jermot Kalan	2.2 to 3.4 cm	95.0
Ladder	2.2 to 3.1 cm	97.5

Salient Observation of Structures

- Performance of all structures remained satisfactory at Khabbal, Jermot Kalan & Laddhar.
- No major displacement of stones was observed during monsoon rainfall
- Natural grass growing in these structures has strengthened the structures.

CROP YIELD RABI-2014-15 RECORDED AT VARIOUS SITES OF STRUCTURES.

		Grain yield (kg/ha)			
		Without structure		With structure	
Site	Crops	Recommended dose of fertilizer	Farmer Practice	Recommended dose of fertilizer	Farmer Practice
R1 (Khalabut)	Wheat	3709	3471	3909	3753

R2 (Khabal)	Wheat	3271	3172	4858	4618
R3 (DMJ)	Wheat	3696	3585	4190	3921
Mean		**3559**	**3409**	**4319**	**4097**

THEME # 2 **WATER CONSERVATION**

EXPERIMENT #. 2.1 **SCREENING OF VARIOUS GRASSES AGAINST MOISTURE STRESS**

Objective: Screening of grasses under natural conditions for providing vegetative cover, palatability to livestock and biomass production.

Research worker: Adnan Umair (PI)&Agricultural Chemist

Duration: 2008-2015

Location: Sohawa (Jhelum)

Methodology: Various grasses having ability to tolerate moisture stress will be tested for suitability. The promising species will be tested for vegetative structures, watts bund and palatability to livestock.

Observation & data collection: Observation on biomass yield and growth habits recorded during growth period under rainfed conditions.

S.No.	Grass Species	Technical name
1	Palwan	Bothriochloa pertursa
2	Baru	Sorghum halepense L.
3	Mott	Pennisetum perpureum Cv. dot mott
4	Babbar	-
5	Kai	Typha latifolia

6	Suryala	Hetropogon contortus
7	Khabbal	Cynodon dactylon
8	Khavi	C. schoenanthus
9	Chingan	-
10	Madhana	Dactyloctenum ageyptium
11	Lemon grass	Cymobopogon citrates

Previous Year's Results/ Accomplishments:

Table-19:- AVERAGE BIOMASS YIELD, PLANT HEIGHT AND SPREADING OF VARIOUS GRASSES FOR RABI 2014-15.

S.No	Grass Species	Av. Height /Plant (m)	Av. Periphery (m)	Biomass yield (t/ha)
1	Khavi	0.80	0.21	0.71
2	Madhana	1.45	0.34	1.36
3	Palwan	0.68	0.45	0.42
4	Lemon	0.46	0.60	10.63
5	Mott	1.84	1.43	40.97
6	Khabbal	0.30	0.32	7.32
7	Kai	1.13	0.82	10.63
8	Suryala	0.71	0.56	6.79
9	Vetiver (khaskhas	0.90	0.47	4.60
10	Chingan	1.29	0.47	10.43
11	Babbar	0.75	0.42	1.35

THEME # 3 **SOIL AND WATER LOSSES MONITORING**

EXPERIMENT #-3.1 **ASSESSMENT OF RUNOFF AND SOIL LOSS IN RUNOFF PLOTS UNDER DIFFERENT VEGETATION COVERS**

Objective: To quantify the extent of surface runoff and soil loss under different slope gradients and crop covers

Research worker: Mr. Kashif Bashir, Dr. Adnan Umair & Agricultural Chemist

Duration: 2009-2015

Location: Village Hafial, (Rawalpindi).

Methodology

Runoff plots
S_1 = 1%
S_2 = 5%
S_3 = 10%

Crop covers
1 = Fallow (tilled)
2 = Gram
3 = Lentil
4= Wheat

Runoff and soil loss will be recorded after each storm
Root growth, biomass and grain yield of each cover crop will be recorded at maturity

Effect of slope gradients and cover crops on soil losses with rainfall.

			Soil losses (t/ha)			
No. of storm	Rainfall (mm)	Slope Gradients	Fallow	Gram	Lentil	Wheat
02	443.2 October 2014 to May 2015	1 %	0.170	0.119	0.087	0.122
		5%	0.258	0.169	0.174	0.230
		10%	0.400	0.263	0.174	0.290
		Mean	0.276	0.184	0.145	0.214

Previous year's results/accomplishment:

EFFECT OF SLOPE GRADIENTS ON BIOMASS YIELD OF COVER CROPS Rabi-2014-15.						
			Biomass yield (t/ha)			
No. of storm	Rainfall (mm)	Slope Gradients	Gram	Lentil	Wheat	
5	443.2 October 2014 to May 2015, 2014.	1 %	4.22	4.44	4.63	
		5%	4.09	4.13	3.88	
		10%	3.95	3.05	3.40	
		Mean	**4.08**	**3.87**	**3.97**	

THEME # 4 **WATER PRODUCTIVITY**

EXPERIMENT No.4.1 **ASSESSMENT AND ENHANCEMENT OF WATER PRODUCTIVITY OF ARABLE VS. HIGH VALUE CROPS USING SUPPLEMENTARY IRRIGATION.**

Objective
- To quantify the water productivity of different arable and high value crops.
- To quantify the economic benefits of use of stored water for high value crops vs. arable crops.

Research workers Dr. Adnan Umair (ARO) & Agricultural Chemist

Duration: 2008-2015

Location: One site in Khallabutt (Rawalpindi)

Methodology

Treatments

1.Arable crop under irrigated conditions

2.High value crops with supplemental irrigation (Citrus with intercropping of vegetables and fodder)

Data Collection

8. Rainfall
9. All variable costs including cost of labour, fuel, inputs ect. in each treatment.
10. Income and yield of arable crop, fruit & vegetables.
11. Plant height & periphery with No. of fruits/plant.

12. Basin diameter of fruit plants to estimate rainwater received through rainfall.

Water productivity (W.P)

W.P in each treatment will be calculated as:

W.P = Fruit yield (kg) / Water use (m^3)

Previous Year's Results/Accomplishments**:**

The position of sweet lime fruit plants is as follow.

S.No	Plants	Total	Existing	Av. No of fruits/plant
1	Sweet lime	40	37	-

Table: Comparative benefit of high value crops vs arable crops Rabi, 2014-15.

	Arable crops (3 kana)	High Value Crops(3 kanal)		
	Wheat	Citrus (Sweet lime)	Garlic (Silver)	Sarsoon (fodder)
Area	3 kanal	7.5 Marla **Basins area**	20 Marla	32.5 Marla
Yield (kg)	488	170 dozen	137	46
Income (Rs)	13657	2553	7508	410
Expenditure (Rs.)	819	501	910	86
Net Income (Rs.)	12838	2052	6598	323
Income (**Rs/ha**)	90208	109442	131950	3977
Expenditure (**Rs/ha**)	5396	26693	17981	1313
Net Benefit (**Rs/ha**)	84812	82749	113969	2664
Difference	199382-84812= 114570			

SOIL & WATER CONSERVATION RESEARCH STATION (SAWCRS), TEHSIL SOHAWA

EXPERIMENT # 01 **RESPONSE OF OLIVE PLANTS TO GYPSUM APPLICATION UNDER RAINFED CONDITIONS OF POTHWAR.**

Importance: The Punjab government has declared the Pothowar area as OliveValley. Therefore to promote and Popularize cultivation of olive in the area is the prerequisite. Gypsum application improves physical properties beside its role in soil moisture conservation.

Objective: To assess the effect of gypsum application on growth, fruit yield of olive plants and fertility status of soil

Research worker: Mr. Hafiz Abdul Rauf, Dr. Adnan Umair, Dr. Rizwan Khalid, (Agri. Chemist)

Duration: 2013-2018

Location: Hafial, Tehsil Sohawa.

Methodology:

T1: Control

T2: Gypsum @ 5 kg plant^{-1}

T3: Gypsum @ 10 kg plant^{-1}

- A recommended dose of NPK will be used for all plants.

Soil Parameters: pH, EC, Soil Moisture, Total Nitrogen, Available phosphorus, Extractable potassium, Calcium + Magnesium, Ca:K and Mg:K ratio.

Plant Parameters: Shoot diameter, Plant height, Fruit yield per plant.

Water productivity (W.P)
W.P in each treatment will be calculated as:

W.P = Fruit yield (kg) / Water use (m^3)

Previous Year Results:

Treatment	Stem diameter (cm)	Plant height (cm)	Canopy diameter (cm)

Control	57	460	325
Gypsum @ 5 kg plant^{-1}	51	468	275
Gypsum @ 10 kg plant^{-1}	57	480	312

EXPERIMENT # 02 **RESTORATION OF ERODED LANDS THROUGH ORGANIC AMENDMENTS IN POTHWAR REGION**

Importance	Upper fertile soil is removed due to sheet erosion by the runoff water during rainfall on sloppy lands of Pothwar region which causes gradually decline in fertility of soils. To grow crops in such soils restoration of their fertility is essential. Organic manures considered to be beneficial in restoring physical properties as well as fertility of the soil.
Objective	To evaluate the impact of traditional organic materials on restoration of soil fertility, physic-chemical properties, moisture conservation and yield of crops in eroded lands of the area
Research worker	Dr. Adnan Umair
Duration:	2013 - 2017
Crop	Wheat
Location:	Farmers fields in tehsil Sohawa, district Jhelum.
Methodology	Following treatments will be applied on selected site of eroded lands that lost upper fertile soil surface through water erosion in farmer fields. T1 = Control T2 = Farm Yard Manure T3 = Poultry Litter T4 = Municipal Solid Waste Compost * Doses of all the manures will be calculated on the basis of N contents of the respective manures (Maintaining N @15 kg / acre in soil). **Parameters** Rainfall at each site. Soil sampling (0-15 & 15-30 cm) before sowing of each crop for initial soil status for particular year (once only) Soil physical properties (Texture, Bulk density, Porosity, moisture content) Soil chemical properties (pH, EC, O.M, Total organic carbon). Yield and yield components of each crop at harvest.

Previous Year Results**:**

Treatments	**1000 seed weigh (g)**	**Straw Y (kg/ha)**	**Seed Yield (kg/ha)**	**Seed Y (t/ha)**
Control	7.85	4636	838	0.84
FYM	7.66	4874	869	0.87
PL	7.65	5228	909	0.91
MSWC	7.41	4730	861	0.86