ANNUAL REPORT
2014-2015

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, and USAID .

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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 WORKERS	1. Syed Zia ul Hasan 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

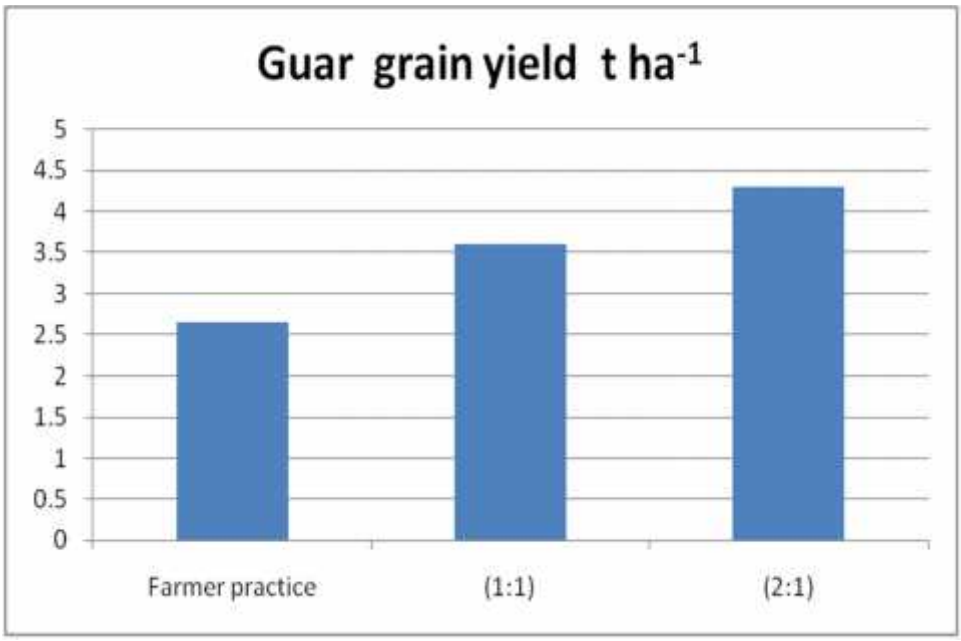
EXPERIMENT # 3.3

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 WORKERS	1. Mr. Ghulam Muhammad 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.

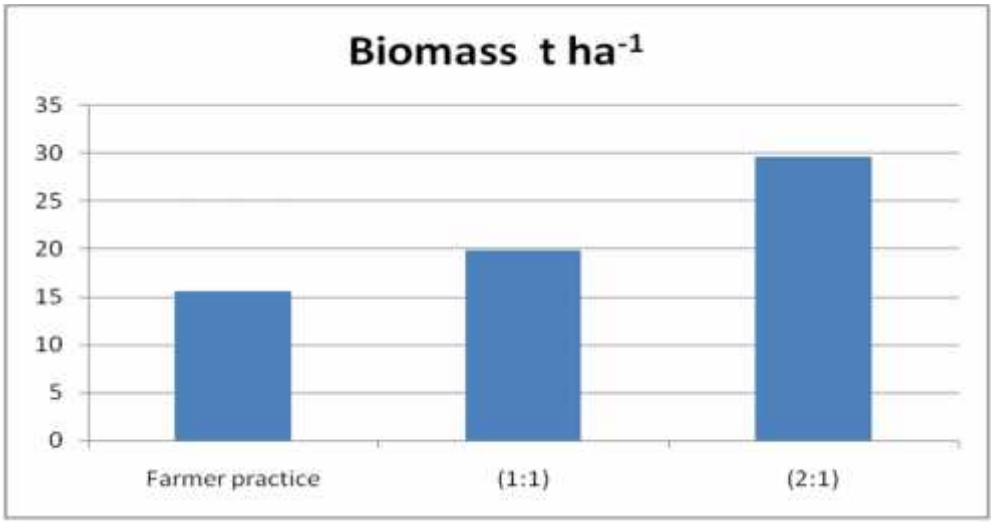
	Crop yield/biomass. Economic analysis

PREVIOUS YEAR RESULTS:

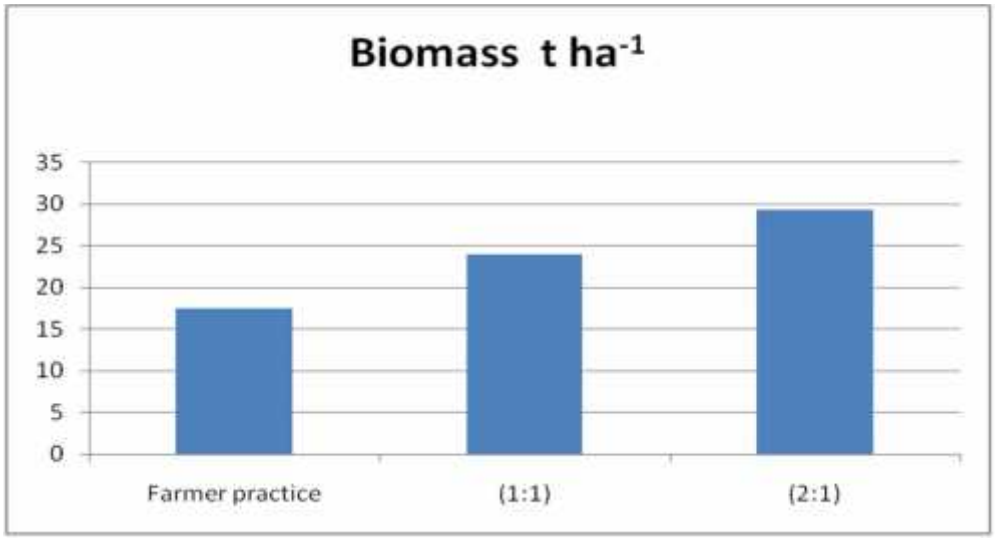
Basic soil analysis	
Soil Texture	Sandy loam
pH	7.8
ECe	0.41 dS m^{-1}
Nitrate-N	4.53 mg kg^{-}
Phosphorus	3.21 mg kg^{-1}
Potassium	121 mg kg^{-1}
Organic matter	0.125 to 0.625
Bulk density	1.38 g cm^{-3}
Infiltration rate	35.3 mm hr^{-1}



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)

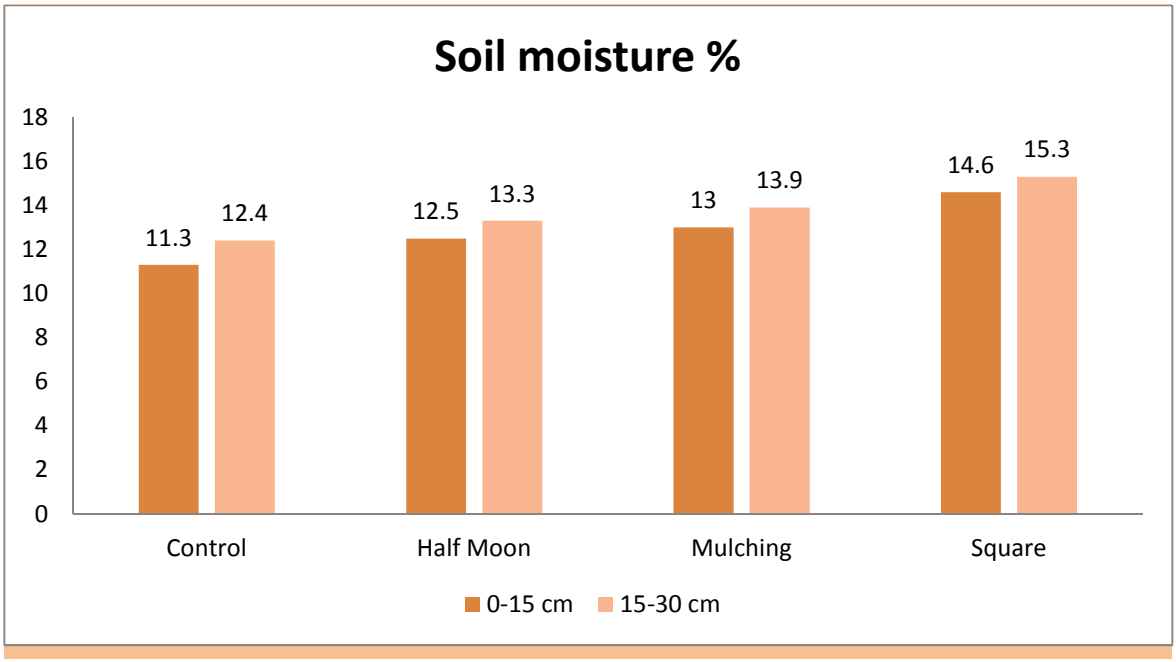
- T1 = no green manure
- T2 = 19.14 t ha^{-1}
- T3 = 18.49 t ha^{-1}

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	2015 to 2020
LOCATION	BARS Fateh Jang
METHODOLOGY	**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: METHODOLOGY	Farmer Fields at *Muqaam* (Fateh Jang) **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

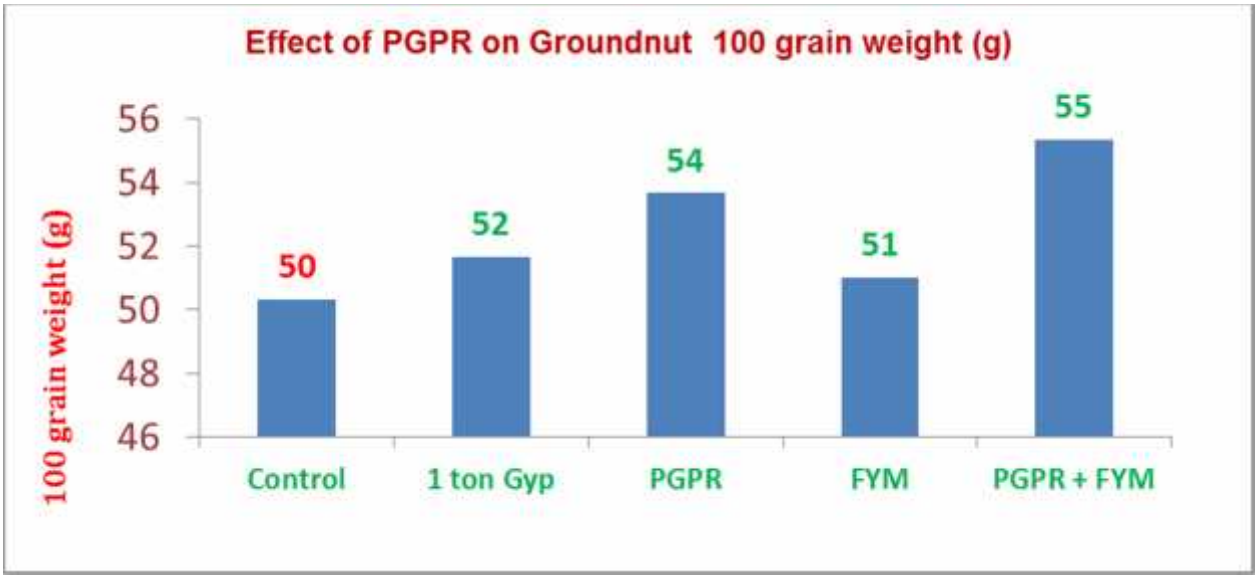
Parameters	Arable crops	High Value crops				
	Wheat	Citrus	Garlic	Carrot	Spinach	Radish
Area	1 acre	1 acre	4 Marla	4 Marla	6 Marla	5 Marla
Yield	19 monds	1068 Dozen	-			
Income (Rs. Grain + straw)	22800	42720	8000			
Expenditure	11000	18500	2500			
Net Income	11800	24220	5500			
Total income	**11800**	**24220+5500=29720**				
Additional Benefits	**29720-11800=17920**					

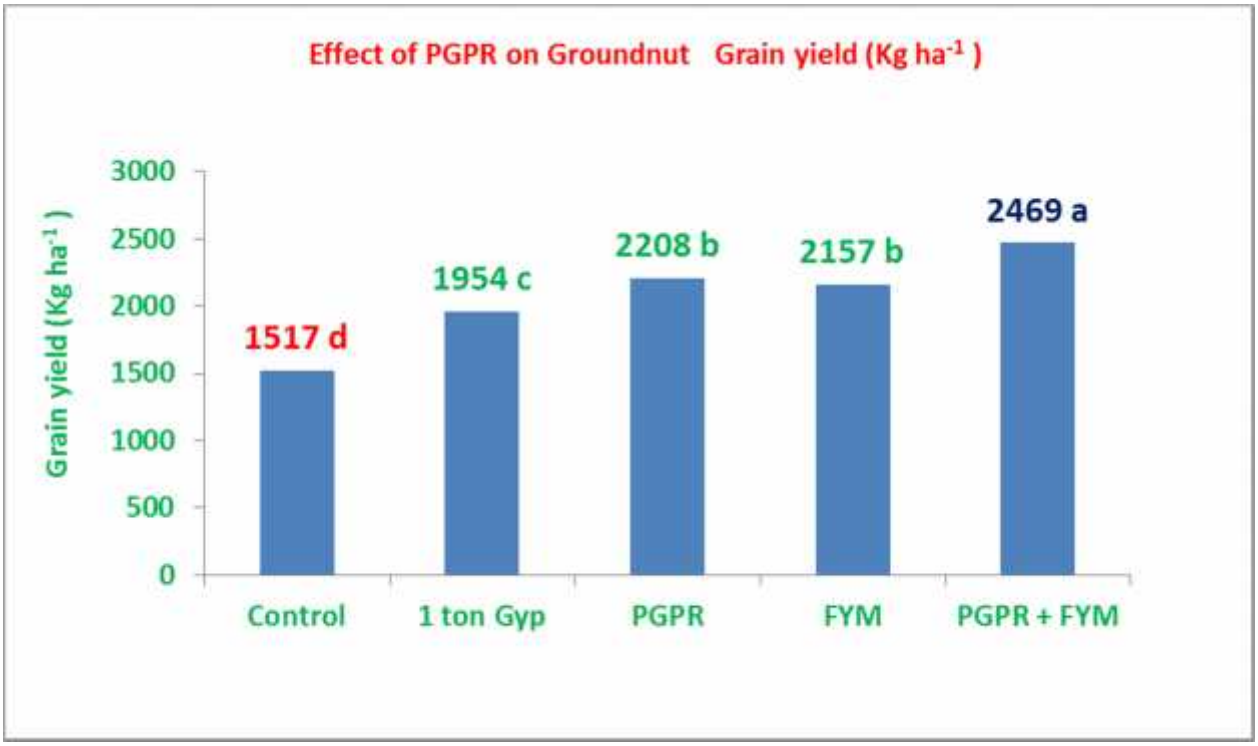
EXPERIMENT # 4.2	
TITLE	**EFFECT OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) CONTAINING ACC-DEAMINASE ACTIVITY FOR IMPROVING GROUNDNUT YIELD UNDER RAINFED CONDITIONS**

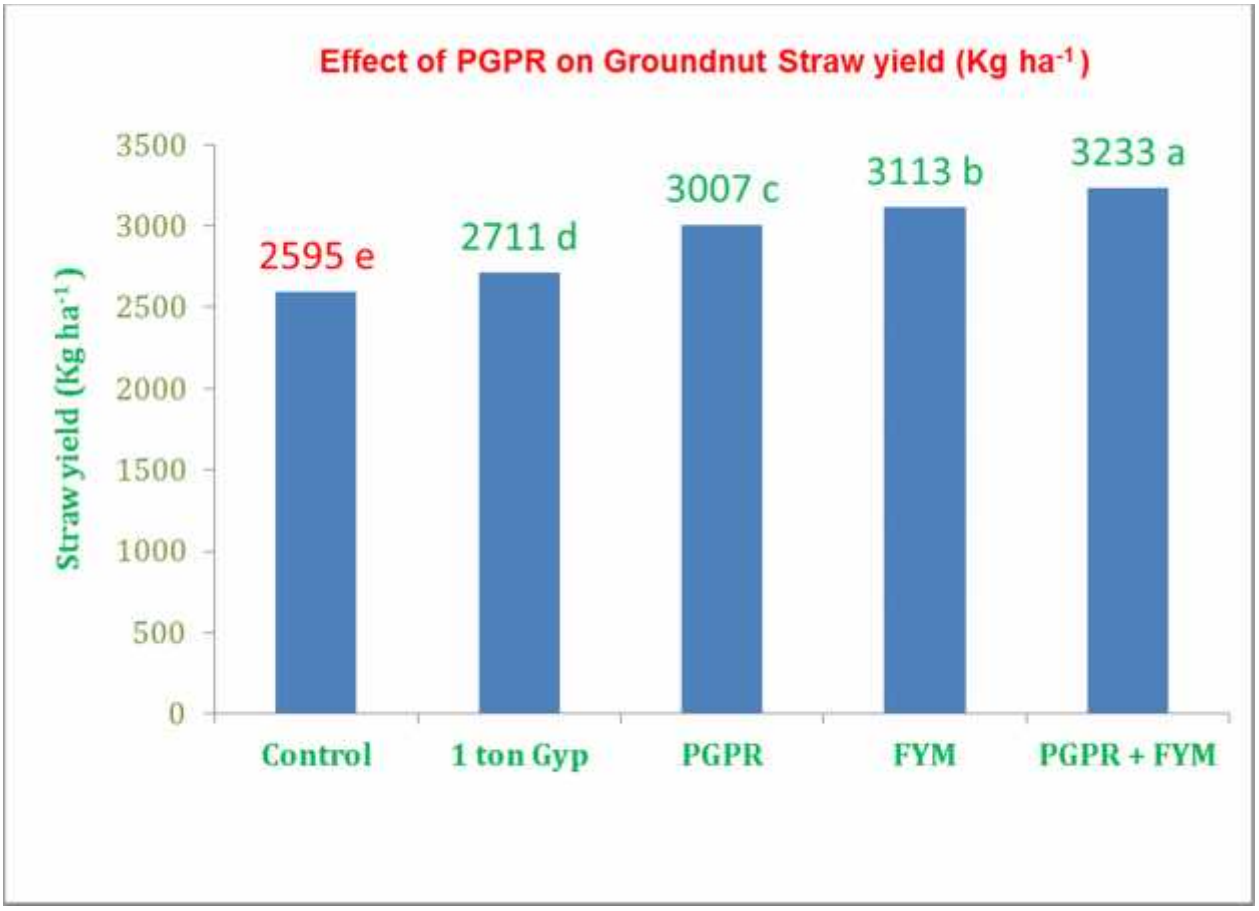
OBJECTIVE	To study the effect of ACC Deaminase activity in Pothowar region for the improvement of groundnut yield
RESEARCHERS	1. Mr. Muhammad Rashid 2. Mrs. Rahina Kausar 3. Dr. Obaid ur Rehman
DURATION	2014-2019
LOCATION: METHODOLOGY	Fateh Jang **Treatments** **1. Control** **2. PGPR inoculation** **3. 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 100 grain weight (g)
100 grain weight (g)
56
54
52
50
48
46
50
52
54
51
55
Control
1 ton Gyp
PGPR
FYM
PGPR + FYM


Effect of PGPR on Groundnut Grain yield (Kg ha-1)
Grain yield (Kg ha-1)
3000
2500
2000
1500
1000
500
0
1517 d
1954 c
2208 b
2157 b
2469 a
Control
1 ton Gyp
PGPR
FYM
PGPR + FYM


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 S_1 = 1% S_2 = 5% S_3 = 10% Crop covers T1 = Fallow (tilled) T2 = mash 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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3.3	In situ moisture conservation practices on the fruit plant growth, moisture use efficiency under the rainfed conditions	
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SAWCRS FATHEJANG

Theme/ Experiment #	Theme/Activity Title	Page No.
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	covers and soil amendments	
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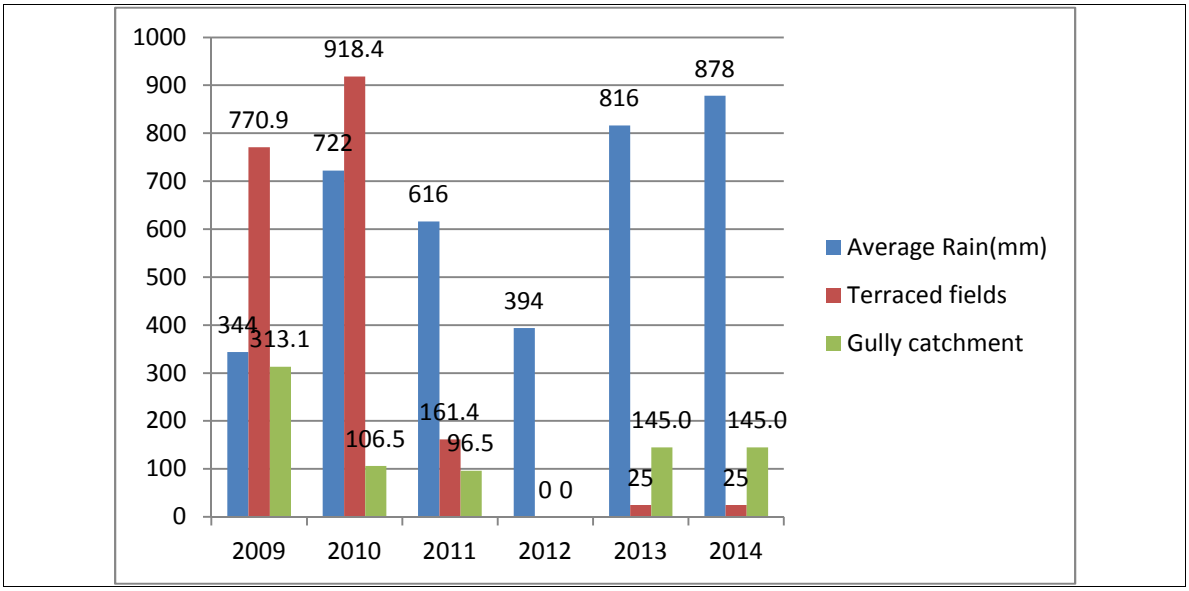
4.2	Fate of phosphatic fertilizers under different rainfall regimes of the rainfed region	

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	4. Mr. Bashir Hussain 5. Dr. Riffat Bibi 6. Mr. M.R. Sajjad
DURATION	2014-2019
LOCATION	Dharabi watershed , District Chakwal
METHODOLOGY	Two land use systems will be investigated in Dharabi watershed including : 3. Gully catchment 4. Terraced field catchment Catchments are already selected and SAWCRI has been collecting soil water losses data since 2009 under natural conditions without interventions. Under this study, SAWCRI will implement interventions during 2014-15. Interventions may include: Runoff harvesting loose stone structures, micro-catchments, check damming, 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.. • Vegetation/land use • Rainfall

PREVIOUS YEAR'S RESULTS/ ACCOMPLISHMENTS



The sediment loss reduced due to the intervention of SAWCRI. The bed load sediment in case of gully catchments reduced from 313.1 kg /ha to 145.1 kg/ha from 2009-2014. The Bedload sediments in terraced fields reduced from 770.9 kg/ ha in 2009 to just 25 kg/ha in 2014

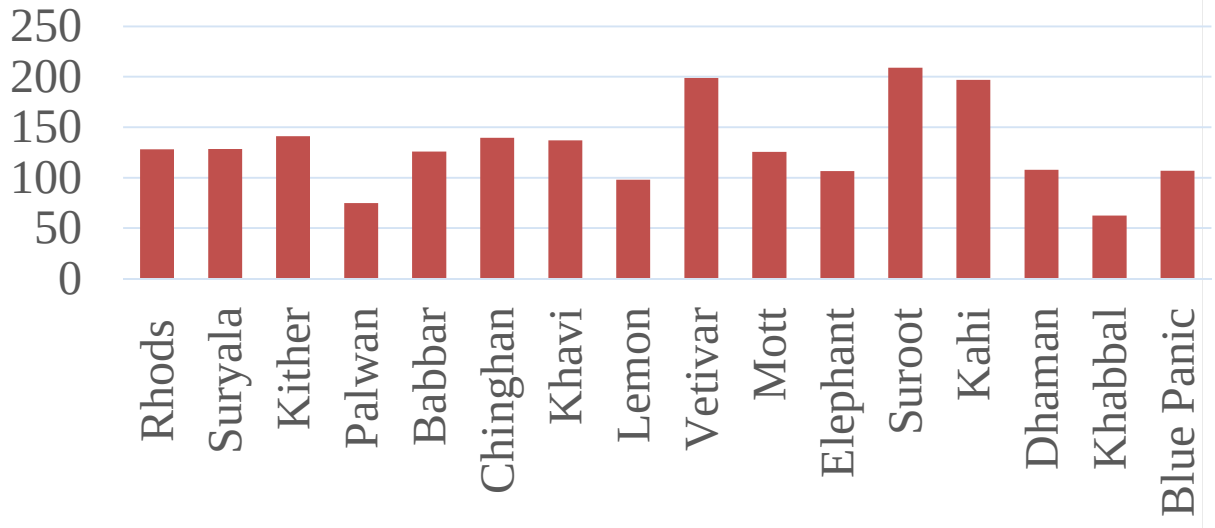
EXPERIMENT # 2.1	

TITLE	**Biodiversity conservation through collection and characterization of indigenous grass, shrub and tree species for range management.**
OBJECTIVE	Maintenance and characterization of indigenous grass, shrub and tree species under rainfed conditions for range management.
RESEARCH WORKERS	1. Mr. Ghulam Muhammad 2. Mr. Waqas Naseem 3. Anwar ul Haq Khalid
DURATION	Continuous
LOCATION	Research Area, SAWCRI Chakwal
METHODOLOGY	**Grass species** 1. *Bothriochloapertusa (Palwan)* 2. *Cenchrusciliaris (Dhamun)* 3. *Chlorisgayana (Rhodes Grass)* 4. *Chrysopogonzizanioides(Khus grass)* 5. *Cymbopogoncitratus (Lemon Grass)* 6. *Cymbopogonjwarancusa (Khawi)* 7. *Cynodondactylon (Khabbal)* 8. *Eleusineflagellifera (Chimber)* 9. *Eulaliopsisbinnata (Babbur)* 10. *Heteropogoncontortus (Suryala)* 11. *Panicumantidotale (Ghamur)* 12. *Pennisetumpurpureum (Elephant Grass)* 13. *Pennisetumpurpureum (Mott Grass)* 14. *Saccharumspontaneum (Kahi)* 15. *Saccharumbengalense*(Saroot) **Shrubs and trees** Acacia Modesta (Phulahi), Acacia Nilotica (Kikar), Albizialebbek (Sarin), Capparis decidua (Karhin), DalbergiaSissoo (Tahli), Meliaazedarach (dharaikh), Morus alba (Toot), Oleaeuropaea (Kaho), Tecomellaundulata (Lahura), Capparisspinosa (Kandeera), Grewiaoccidentalis (Gungir), Dodonaeaviscosa (Snatha), Maytenusemarginata (Kanheer), Prinsepiautilis (Bahaikar), Zizyphusnummularia

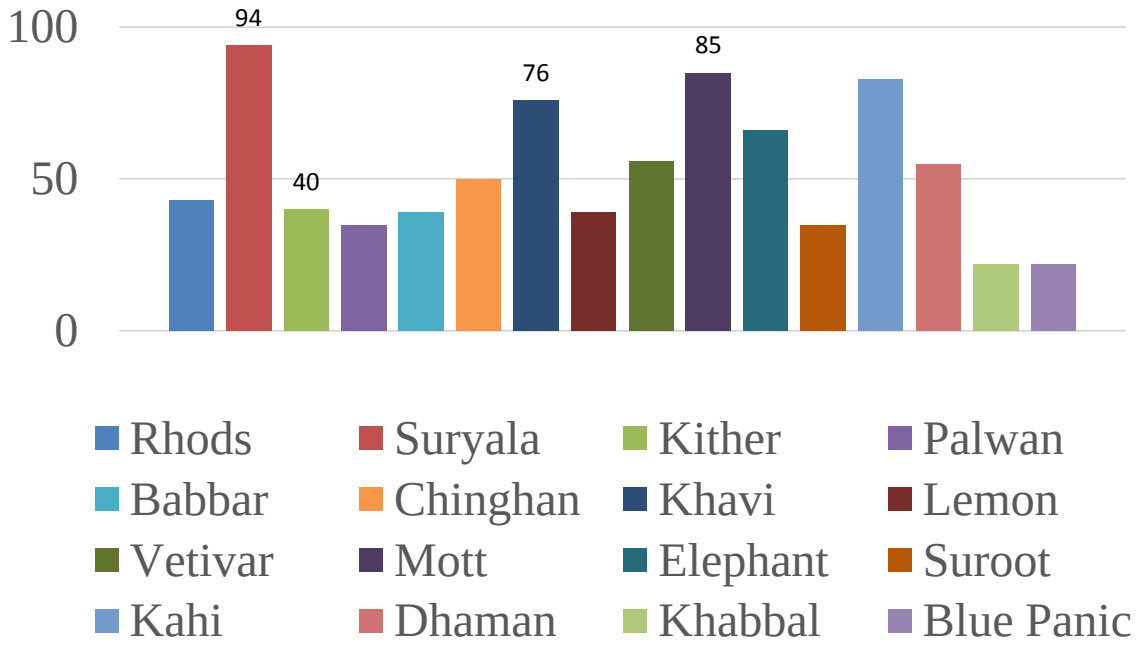
	(Jhari)……. All plant species will be evaluated/maintained under rainfed conditions, after establishment in research area. **Parameters** Grasses: Biomass, canopy cover, palatability Shrubs and trees: Biomass, canopy cover, stem girth, height.

PREVIOUS YEAR'S RESULTS/ ACCOMPLISHMENTS

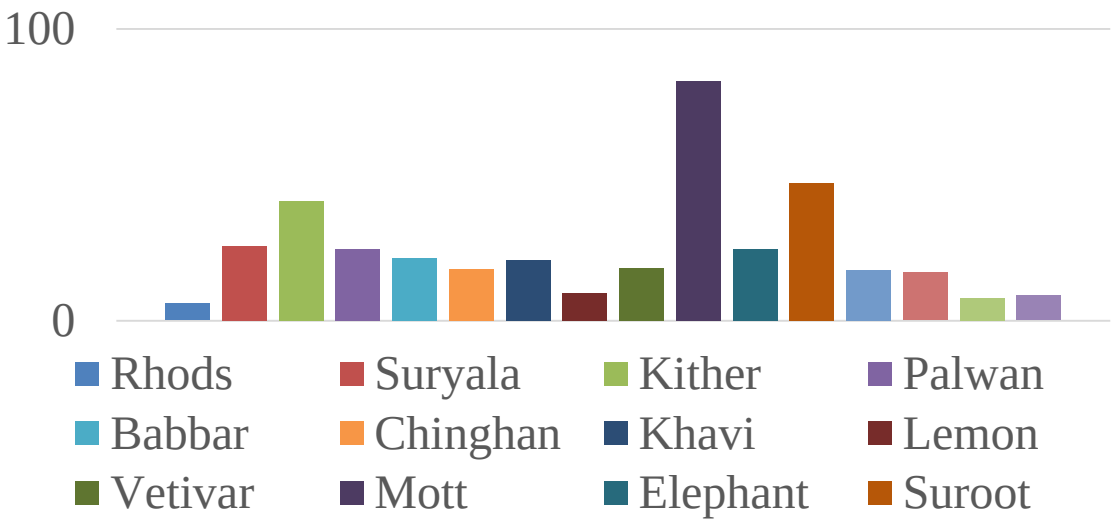
Plant height (cm)



Plant canopy (cm)



Biomass Ton/ha



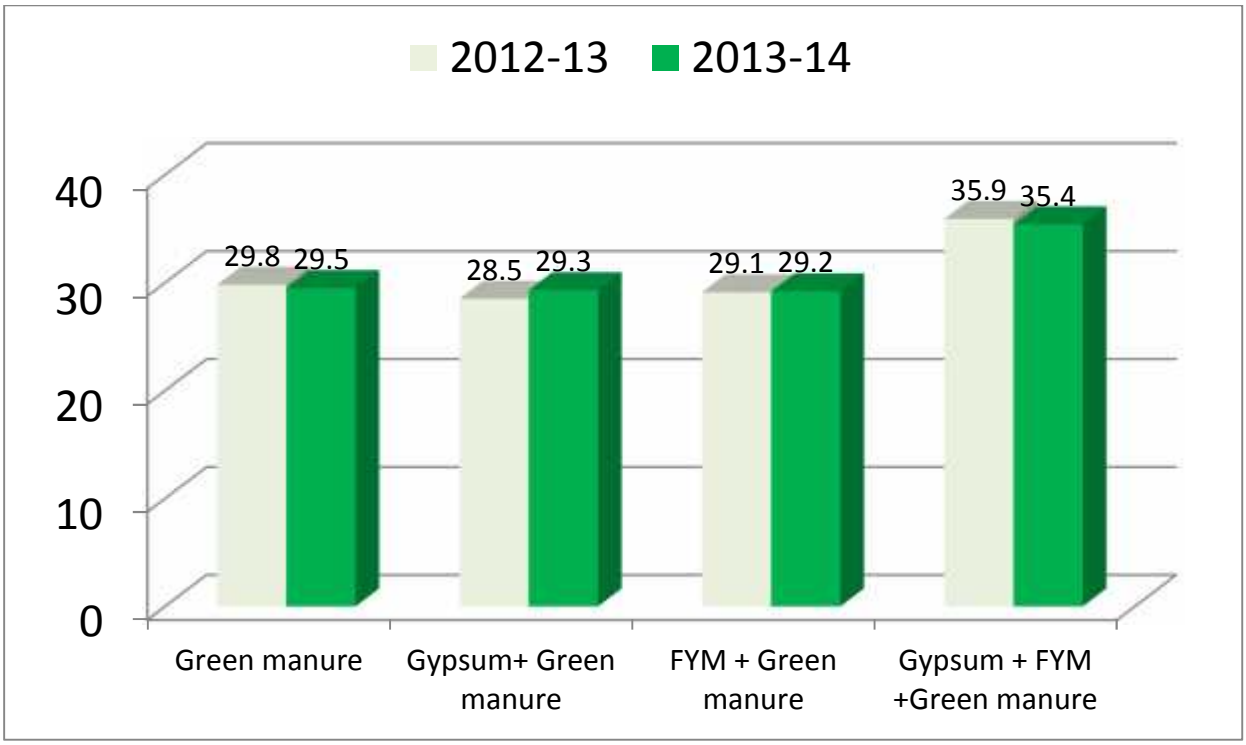
EXPERIMENT # 2.2	
TITLE	**EVALUATION OF MECHANICAL CHECKDAMS FOR SOIL CONSERVATION IN UNCULTIVATED GULLIED AREAS.**
OBJECTIVE	To assess gully bed development rate for gully farming in un-cultivated gullied areas.
RESEARCH WORKERS	4. Mr. Bashir Hussain 5. Dr. Riffat Bibi 6. Mr. M.R. Sajjad
DURATION	2014-2019
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 was done with GIS/GPS support and remaining check dams will be developed during 2014-15 based on survey to cover entire watershed. Boundary of sub-watershed was 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: 4. Soil deposition 5. Land use 6. Soil fertility

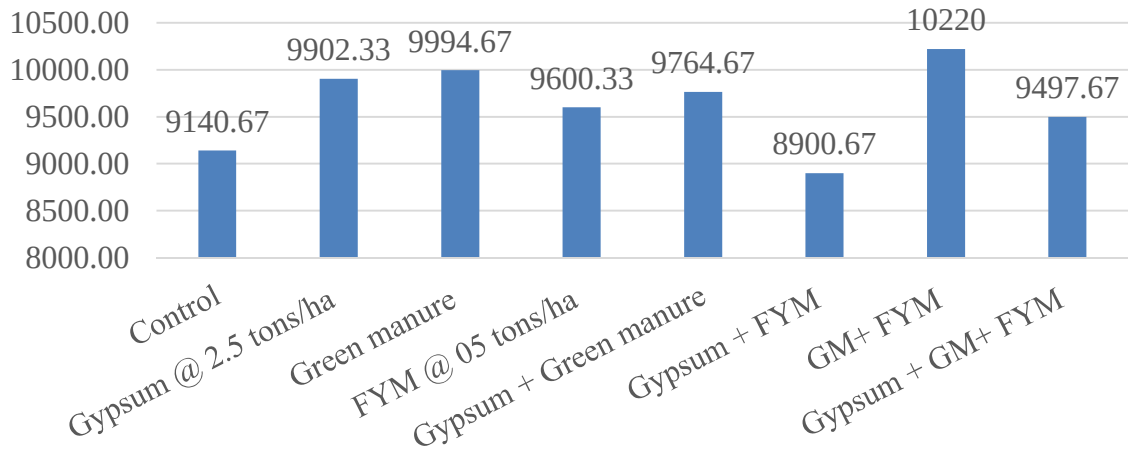
PREVIOUS YEAR'S RESULTS/ ACCOMPLISHMENTS First Year

EXPERIMENT # 3.1	
	INTEGRATED USE OF GREEN MANURING, GYPSUM AND FARM YARD MANURE FOR WHEAT CROP UNDER RAINFED CONDITION
OBJECTIVE(S):	The study has been planned to evaluate the integrated use of gypsum, green manures and FYM for moisture conservation and yield of subsequent crop.
RESEARCH WORKERS	Mr. Ghulam Muhammad Mr. Riaz Hussain Khan
DURATION:	2011-12 - 2013-15

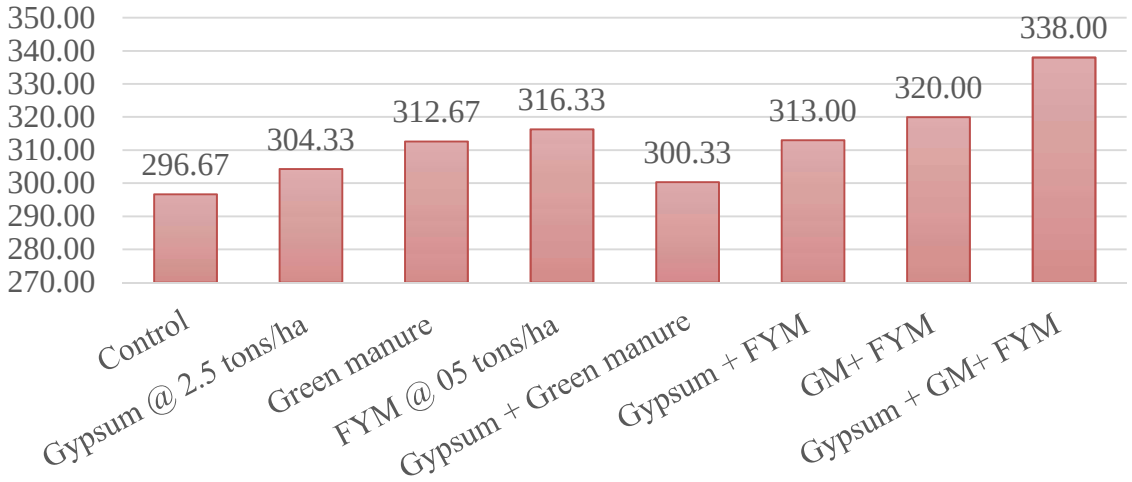
LOCATION:	Research area, SAWCRI Chakwal
METHODOLOGY	Treatments: T1- Control T2- Gypsum @ 2.5 tons per ha T3- Green manure (Guar/cowpea) T4- FYM @ 05 tons per ha T5- Gypsum + Green manure T6- Gypsum + FYM T7- GM+ FYM T8- Gypsum + GM+ FYM Replications: 03
PARAMETERS	Soil: pH, EC, OM, Available P, Ext K, Soil Texture at start of study Plant: Biomass yield of green manures Soil Moisture at sowing and incorporation of Green Manure and at sowing and harvesting of wheat.



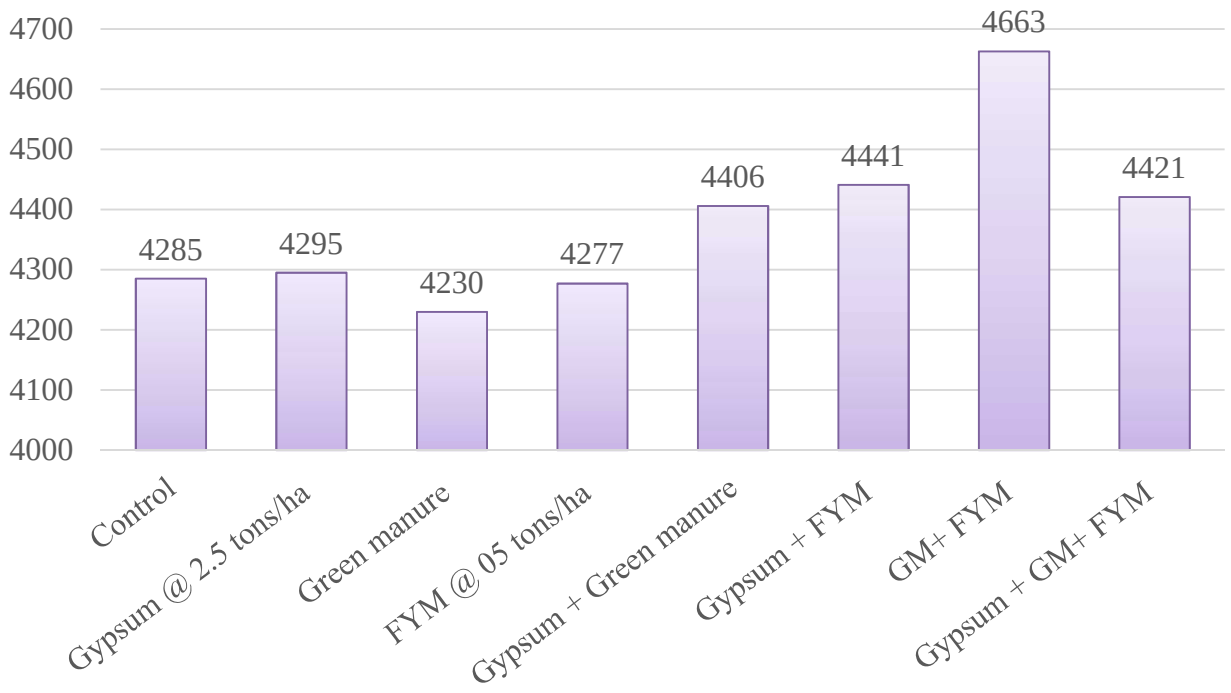
Biomass Kg/ha



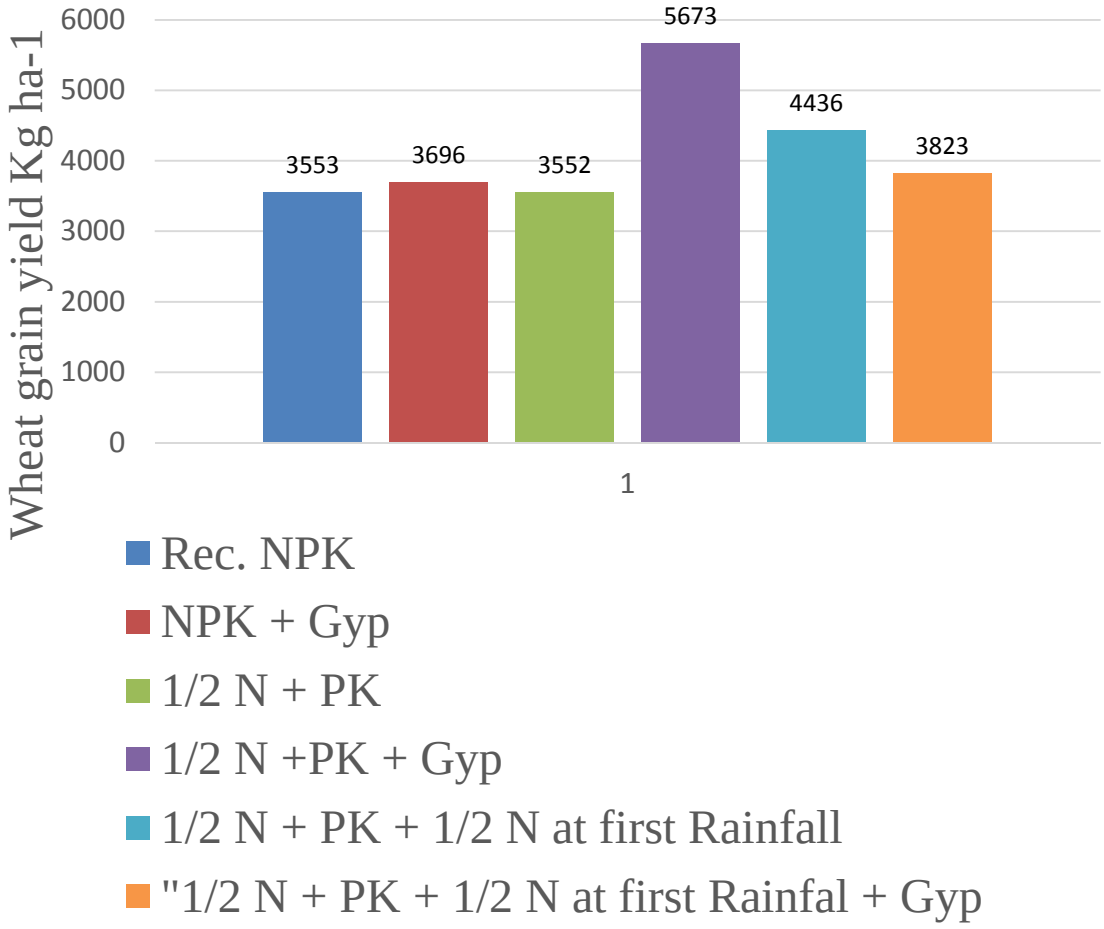
No of tillers/m^2



Grain Yield Kg/ha

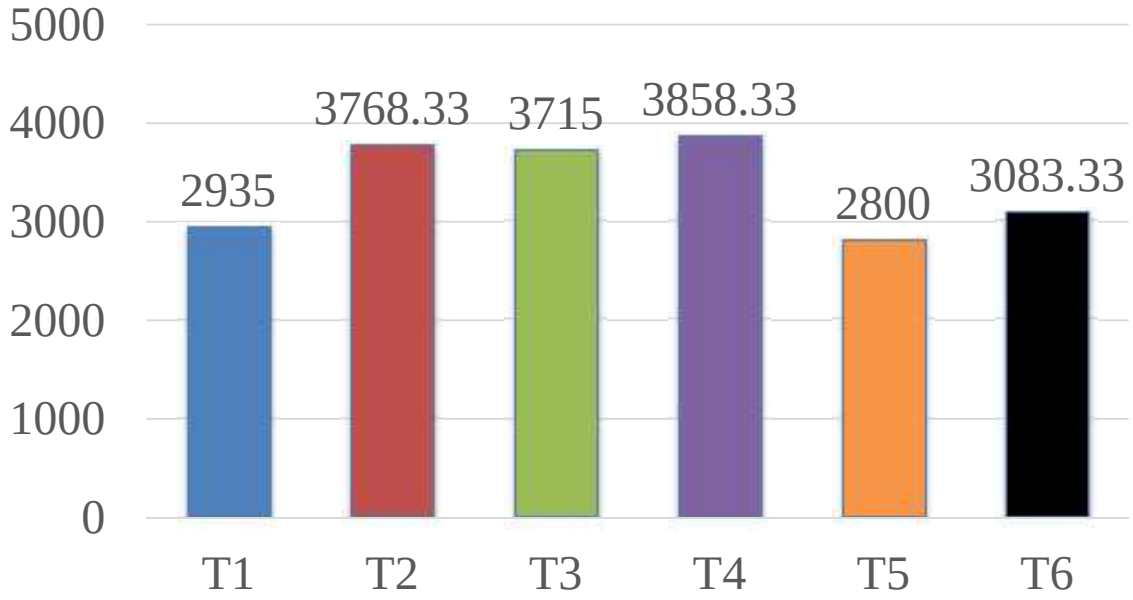

4700
4600
4500
4400
4300
4200
4100
4000
4285
4295
4230
4277
4406
4441
4663
4421
Control
Gypsum @ 2.5 tons/ha
Green manure
FYM @ 05 tons/ha
Gypsum + Green manure
Gypsum + FYM
GM+ FYM
Gypsum + GM+ FYM

EXPERIMENT 3.2	**INFLUENCE OF GYPSUM APPLICATION ON NITROGEN USE EFFICIENCY IN RAINFED WHEAT**
OBJECTIVE	To investigate the efficiency of nitrogen for wheat as influenced by the application of gypsum on a normal soil.
RESEARCH WORKERS	1. Miss Safia Naureen Malik 2. Mr. Waqas Naseem
DURATION	2012-13 to 2014-15
LOCATION	SAWCRI Farm Chakwal
METHODOLOGY	Treatments: T1= Recommended dose NPK T2 = Recommended dose NPK+ G T3= ½ N + recommended PK T4= ½ N + recommended PK + G T5= ½ N + recommended PK + ½ N at first rainfall T6= ½ N + recommended PK + G+ ½ N at first rainfall Note: Gypsum will be applied @ 2.5 tonn ha^{-1} once
PARAMETERS	Soil analysis (Pre sowing and post harvest) pH, ECe, N, available P and extractable K Analysis for moisture determination Up to 90 cm at wheat sowing and at two month interval. Observation and data collection Germination • Productive tillers • 1000 grain weight • Grain yield • Harvest Index

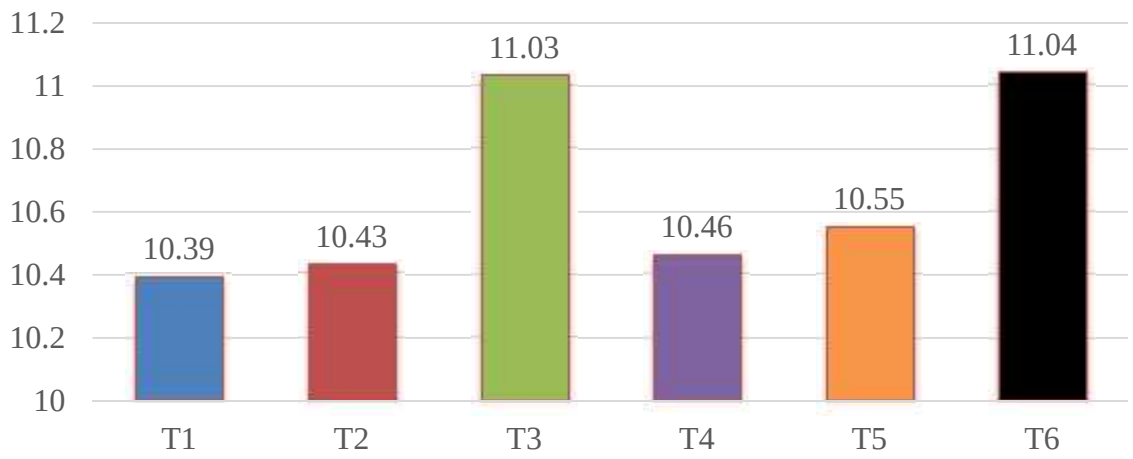


Soil Moisture % at sowing

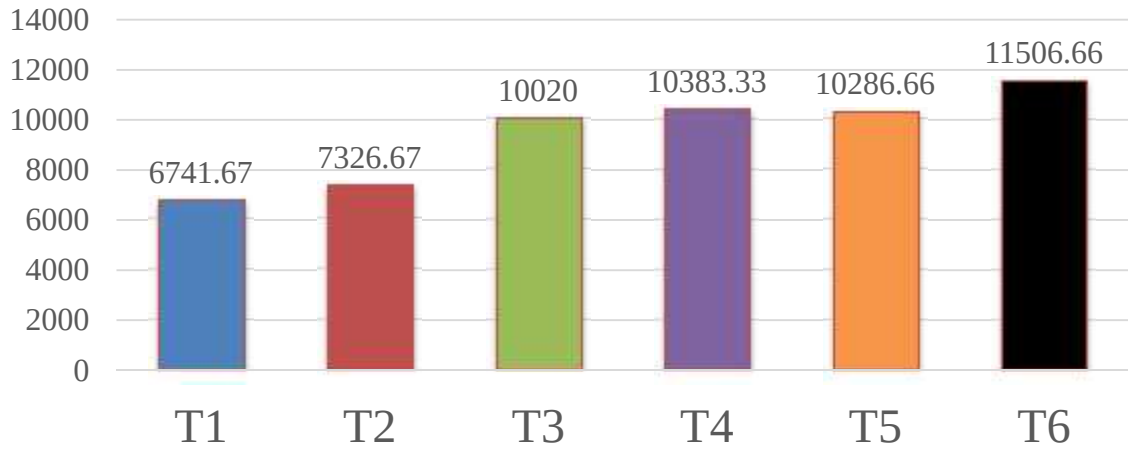
Grain Yield Kg/ha



Soil Moisture % at harvest



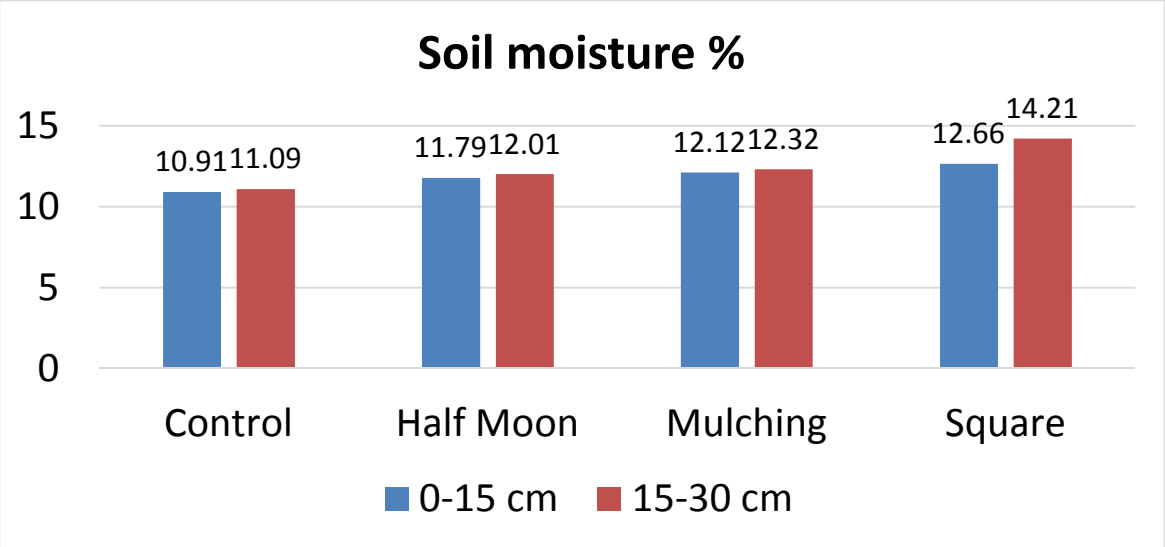
Biomass Kg/ha



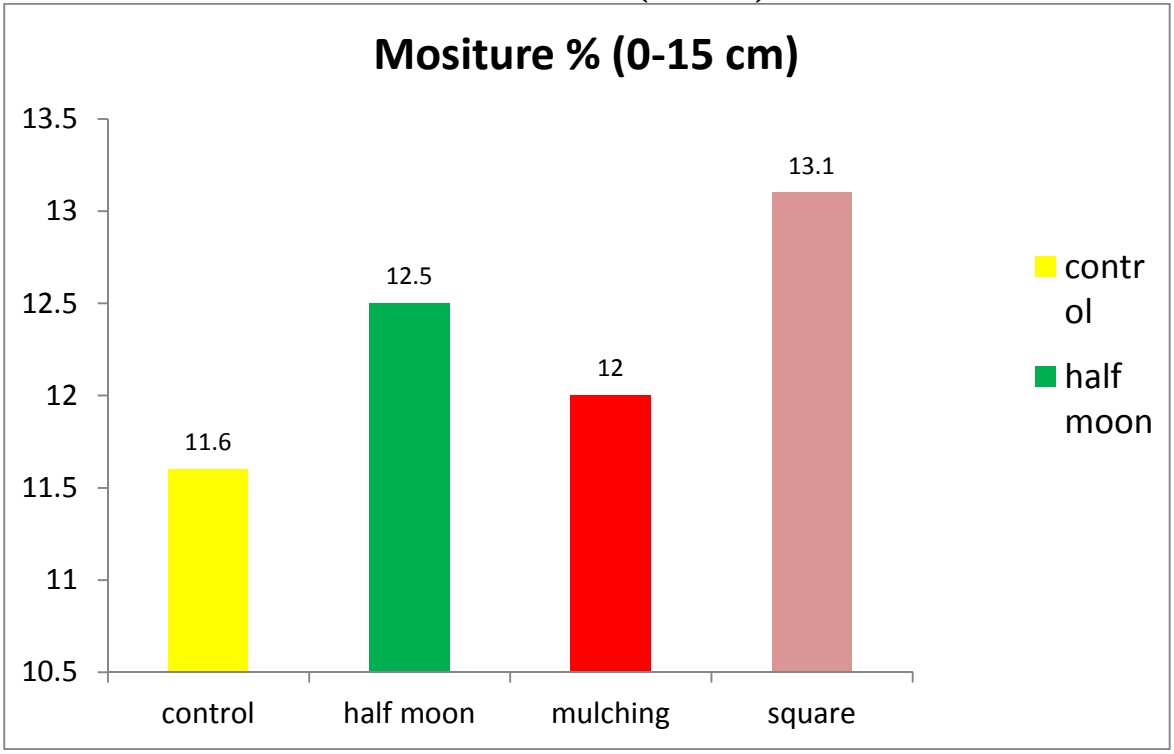
EXPERIMENT 3.3	**In situ moisture conservation practices on the fruit plant growth, moisture use efficiency under the rainfed conditions**
OBJECTIVE	To investigate the effect of different moisture conservation techniques on the plant growth, and how it facilitate them to control nutrient loss and soil

	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 **PARAMETERS**	• **Treatments are tested with and without cover crop:** • T1 = Control • T2 = Half moon terracing • T3 = Mulching with locally available grasses • T4 = Square micro catchments • 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

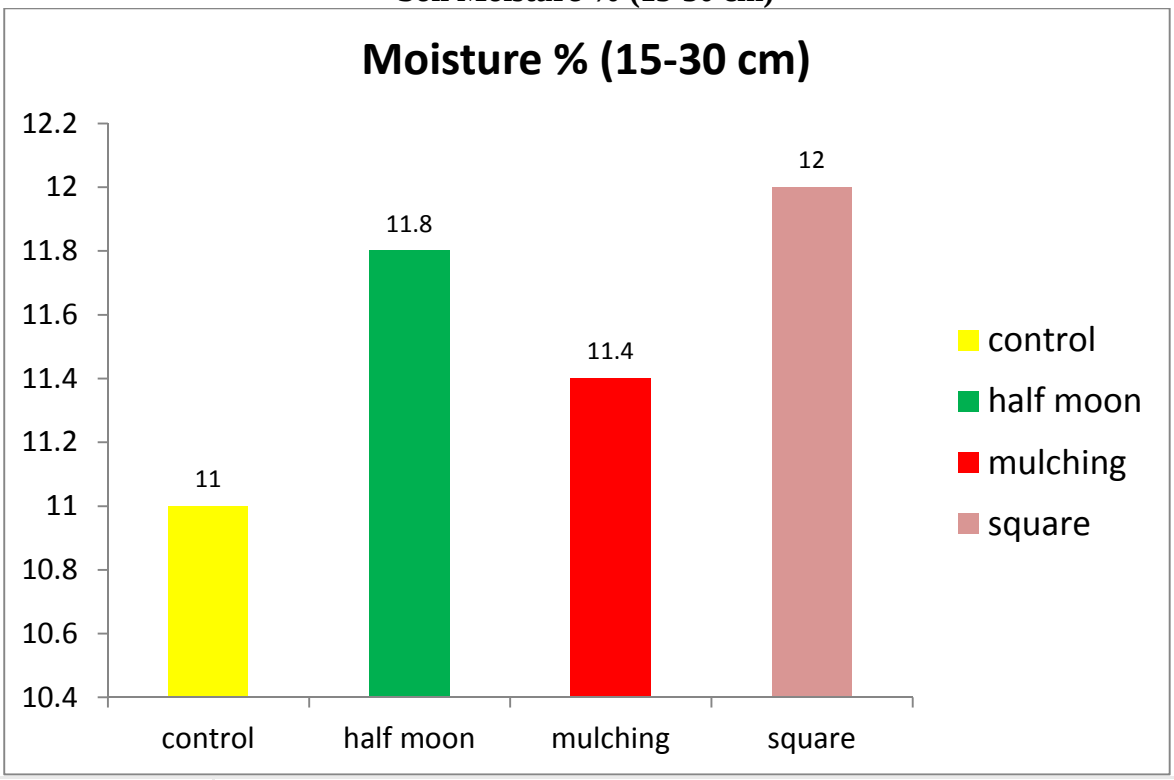
Moisture percentage in different micro catchments with cover



Soil Moisture % (0-15 cm)

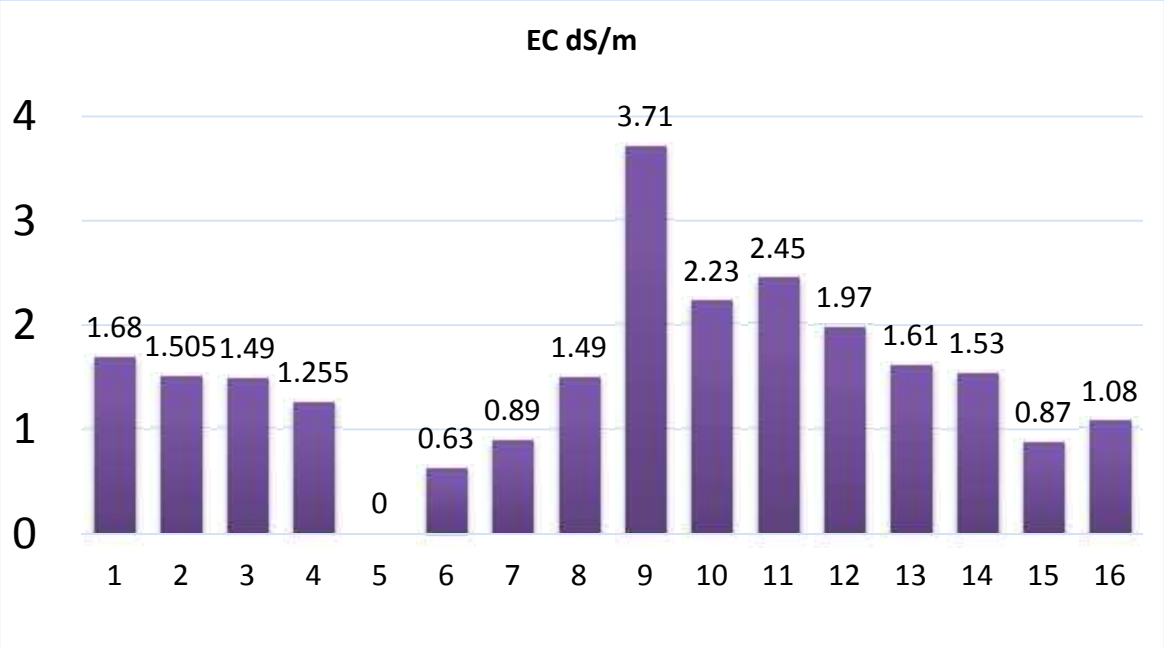


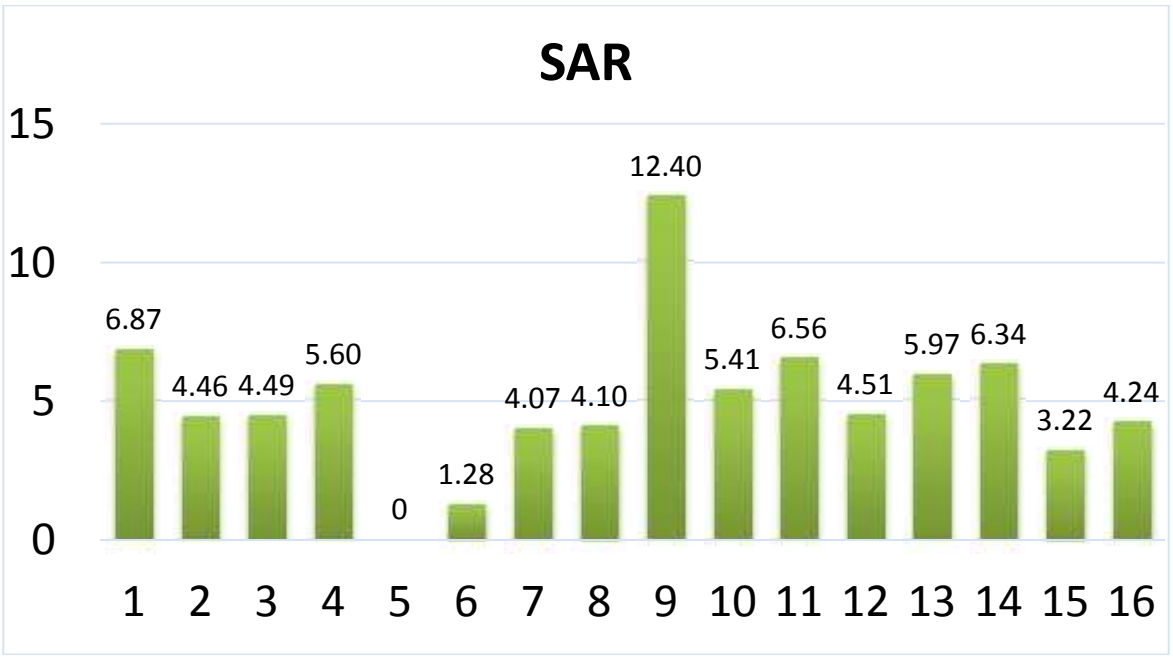
Soil Moisture % (15-30 cm)

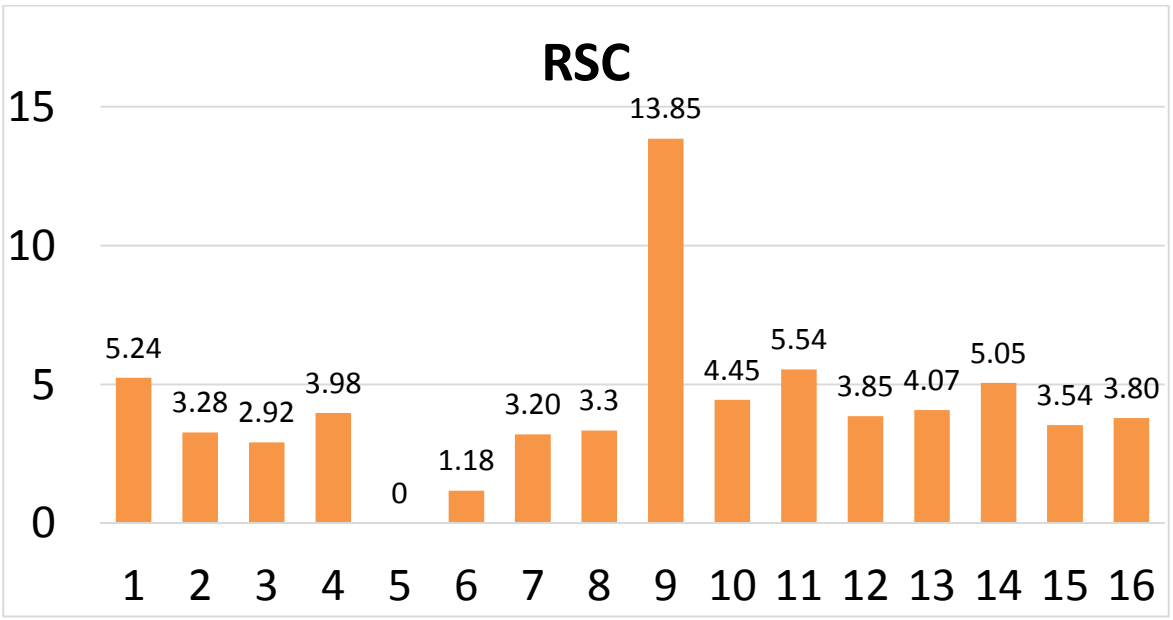


EXPERIMENT 3.4	**Assessment of surface and ground water quality in Dharabi watershed Chakwal**
OBJECTIVE	To Evaluate the spatial changes in the water quality of Dharabi watershed. This study investigates the natural and anthropogenic processes that influence the chemistry of surface and ground water.
RESEARCH WORKERS	Safia Naureen Malik Waqas Naseem
DURATION	continous
LOCATION	Kallar Khar , Ratta Sharif , Rhna Sadat,Dhok Mohri

METHODOLOGY	**Water Quality** • Water samples are being collected periodically at one month interval
PARAMETERS	**Parameters** • Samples are being analyse for EC, SAR, RSC







EXPERIMENT # 3.5	
TITLE	**IMPROVING CROP PRODUCTIVITY THROUGH IN-SITU MOISTURECONSERVATIONPRACTICES**
OBJECTIVE	Objective: To reveal the effect of crops residues, tillage, no-

	tillage and rotation on (i) Soil water contents (ii)Wheat yield (iii) Soil organic matter status
RESEARCH WORKERS	1. Waqas Naseem 2. Ghulam Muhammad
DURATION	2014-2018
LOCATION	SAWCRI, Chakwal.
METHODOLOGY	**Treatments** **A. Tillage** • **T1:** Tillage • **T2:** Min-tillage **B. Rotation** • **T1:** Wheat–fallow–wheat-fallow • **T2:** Wheat– groundnut–wheat-groundnut **C. Residues** • **T1:** (residues removed) • **T2:**(residues retained) **Design: Split split plot design** • Tillage & Min-tillage in main plot • Rotation in sub plot • Residues in sub sub plot **Parameters:** Soil samples (0-15 cm) will be collected at start of experiment for(Soil pH, ECe, Texture, OM, Available P, Ext. K) • Soil Moisture (0-30 &30-60 cm) at one month interval • Germination % • No of tillers m^{-2} • Plant height

	• Grain yield • 1000 grain weight

PREVIOUS YEAR'S RESULTS/ ACCOMPLISHMENTS First Year

EXPERIMENT # 3.6	
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
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'S RESULTS/ ACCOMPLISHMENTS First Year

EXPERIMENT No. 3.7	**EFFECT OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) CONTAINING ACC-DEAMINASE ACTIVITY FOR IMPROVING WHEAT YIELD UNDER RAINFED CONDITIONS**
OBJECTIVE(S):	To study the effect of ACC deaminase activity in Pothwar region for the improvement of wheat yield
RESEARCH WORKER (S):	Mr. M. Rafique Sajjad Mr. Syed Zia ul Hasan Mr. Ghulam Muhammad **Collaboration** Dr. Azeem Khalid, Associate Professor. PMAS AAU, Rawalpindi
DURATION:	2011-12 to 2014-15
LOCATION:	Research Farm, Chakwal
METHODOLOGY	**Treatments:** 1. Control 2. PGPR (with ACC deaminase activity) inoculation

	3. Gypsum @ 1 ton/acre 4. Gypsum + PGPR inoculation • Peat based inocula applied through seed treatment prior to sowing. • Recommended dose of mineral fertilizer applied to all treatments. **Parameters** Soil: pH, ECe, OM, Available P, Ext K, Soil Texture at start of study • Grain yield of wheat • Straw yield of wheat

Treatments	**Straw Yield kg ha^{-1}**	**Grain Yield kg ha^{-1}**
Control	6328	4662
PGPR	6787	4950
Gypsum	7447	5228
Gypsum+PGPR innoculation	7695	5320

4. Water Productivity

Experiment 4.1	**Water harvesting in dryland areas adopting micro-watershed approach of Strip Cropping for Crop productivity enhancement**
OBJECTIVE	To assess feasibility of strip cropping on soil water status &crop productivity in low rainfall areas.
RESEARCH WORKERS	1. Ghulam Muhammad 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 = Two Crops under study: Wheat (grain 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	First Year

SOIL AND WATER CONSERVATION RESEARCH STATION,FATEH JANG

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**
BACKGROUND	Physical and chemical properties of soils can vary depending on the soils position in the local topography. The topography of an area can affect the microclimate, soil formation, parent material and hydrological and geological processes, which in turn affect soil processes. Topographic factors such as the steepness of the slope

affect the microclimate, vegetation establishment, water movement, and erosion. Slope aspect also influences the soil temperature, vegetation establishment and moisture levels. These factors in turn can affect the distribution of soil organic matter, pH, and nutrient levels.

OBJECTIVES

1. Quantification of runoff water and sediment loss at different slope gradients.
2. Quantification of soil nutrients loss through runoff Water against different soil amendments and crop Covers at different slope gradients.

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

2. Mr. Muhammad Imran Akram
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

- Recommended rates of chemical fertilizer,Compost @ 250 Kg $Ac^{-1}$and Gypsum@1000 Kg Ac^{-1}will be applied

Runoff and soil loss has been measured by using the standard runoff/erosion plots as described in 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. Run off and sediment yield was measured 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 sediment was filtered, oven-dried at 105 ^{0}C and weighed andwas analyzed for NPK and micronutrients (Zn, Fe, Mn and Cu).

Rainfall Measurement

Intensity of rainfall was measured at study site with rainfall gauge.

Soil Analysis

Basic soil analysis was carried out before the initiation of this experiment along with analysis of soil amendments

Rabi 2013-14

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

No. of storms>20mm	Rainfall (mm) Oct 13 to March 14	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum
5	383	1	1.88	0.94	1.00	0.81
		5	2.00	1.16	0.96	1.12
		10	4.22	3.08	2.26	1.90
		Mean	**2.70**	**1.73**	**1.41**	**1.28**

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

No. of storms>20mm	Rainfall (mm) Oct 13 to March 14	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum
5	383	1	310.28	203.22	196.5	184.15
		5	362.52	304.41	281.24	250.5
		10	492.6	407.85	367.33	320.45
		Mean	**388.47**	**305.16**	**281.69**	**251.70**

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

No. of storms>20mm	Rainfall (mm) Oct 13 to March 14	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum
5	383	1	2791	4690	3604	3130
		5	2310	3509	2903	2614
		10	2009	3120	2809	2414
		Mean	**2370 c**	**3773 a**	**3105 b**	**2719 bc**

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

No. of storms>20mm	Rainfall (mm) Oct 13 to March 14	Slope Gradients (%)	Control	Chemical Fertilizer	Compost	Gypsum
5	383	1	2932	5439	4220	3503
		5	2413	4154	3324	2842
		10	2207	3648	3153	2615
		Mean	**2517 c**	**4414 a**	**3566 b**	**2987 c**

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	0.9	0.8	9.0	1.5	1.1	7.4	0.4	0.5	9.2	0.3	0.4	8.0
5	1.7	0.8	10.3	2.0	1.2	8.6	0.9	0.6	10.2	0.4	0.5	8.9
10	2.4	1.1	13.0	2.8	1.4	9.0	1.0	0.8	12.0	0.6	0.6	10.2
Mean	**1.7**	**0.9**	**10.8**	**2.1**	**1.2**	**8.3**	**0.7**	**0.6**	**10.5**	**0.4**	**0.5**	**9.0**

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	0.11	0.38	0.10	0.46	0.12	0.30	0.28	0.65	0.02	0.19	0.14	0.28	0.09	0.20	0.10	0.44
5	0.35	0.55	0.21	0.55	0.40	0.50	0.33	0.83	0.19	0.30	0.16	0.40	0.11	0.32	0.22	0.48
10	0.46	0.60	0.26	0.90	0.66	0.68	0.48	0.96	0.23	0.42	0.28	0.66	0.16	0.38	0.30	0.53
Mean	0.31	0.51	0.19	0.64	0.39	0.49	0.36	0.81	0.15	0.30	0.19	0.45	0.12	0.30	0.21	0.48

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**
BACKGROUND	The majority of the developing worldis faced with the need to increase agricultural production. One of the challenges of rainfed regionis output from the land without destroying the soil resource. Erosion-induced loss in soil productivity is now recognized as one of the principal threats to agricultural sustainability in sloppy lands.Grasses live barriers and other SWC technologies are contributing towards more sustainable agriculture and rural development in many parts of the world.
OBJECTIVE (S)	Selection of value added grasses under natural conditions for providing vegetative cover, palatability to livestock, biomass production and economic return
RESEARCH WORKERS	1. Mr. Muhammad Imran Akram(PI) 2. Mrs. Rahina Kausar 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 being tested for suitability. The grasses species were selected on the basis of their economic contribution and use. The selected species are being tested for vegetative barrier for SWC on watts and bunds/marginal landsand their palatability to livestockand other suitable uses **Grass Species** Paltosa, Vetiver, Panicum, Canckrus **Observations and data collection** Observations on biomass, survival habits, spreading ability,

heightand economic use will be assessed

Physico-chemical analysis of site

Parameter	**Value**
pH	7.96
Bulk Density (g cm^{-3})	1.61
O.M (%)	0.77
EC_e(dS m^{-1})	1.08
P (mg Kg^{-1})	4.9
K (mg Kg^{-1})	87

Name	**Plant Height (cm)**	**Plant canopy (cm)**	**Biomass (t ha^{-1})**
Paltosa	129 b	120 a	2.19 b
Vetiver	240 a	132 a	4.35 a
Panicum	227 a	138 a	2.73 ab
Canckrus	111 b	60 b	3.10 ab
LSD	83.14	40.60	1.74

EXPERIMENT # 2.2

TITLE	**IMPACT OF LAND USE INTENSITY AND TYPE ON SOIL PROPERTIES: OPPORTUNITIES AND IMPLICATIONS**
BACKGROUND	Land use is a main derivative which influences soil resources in degraded lands (Gonz, 2013). This change occurs slowly but it damages the soil sustainability which consequently reduces the soil productivity in eroded lands (Spurgeon, 2013: Latty, 2004).
OBJECTIVES	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
RESEARCH WORKER (S):	1. Mrs. Rahina Kausar (PI) 2. Mr. Muhammad Imran Akram 3. Dr. Obaid ur Rehman
DURATION	2014-2020
LOCATION	Fateh Jang / Jand Areas
METHODOLOGY	**Treatments/Cropping System** • Cereal – Fallow • Fallow – Legume • Cereal– Legume • Orchard Trees **Observations** Inputs data Income data **Soil Sampling**

3 sites varying in rainfall 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 30-60 cm) at 3 stages of crop growth (at sowing, booting&harvesting)

Soil Analyses

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

Statistical analysis

RCBD will be used for statistical analysis.

Rainfall Measurement
Rainfall will be noted for each sampling sites

THEME # 3

WATER CONSERVATION

EXPERIMENT# 3.1

TITLE

POTENTIALS AND PROSPECTS OF HYDROGELS FOR SOIL MOISTURE CONSERVATION UNDER RAINFED CONDITIONS

BACKGROUND

Addition of hydrogels enhances the water holding capacity of soil. (Huttermann, 1999). They reduce the bulk density (Al-Harbi *et al.,* 1999). It has been found that hydrogel application reduced phosphorus loss by 84%, nitrogen 33% and sediment load by 57%. (Lentz and Shojka, 1994)

OBJECTIVE

To study the effect of hydrogels application for soil moisture conservation and its impact on high value crop*i.e.,* Citrus

RESEARCH WORKERS

1. Mr. Muhammad Rashid (P.I)

2. Mrs. Rahina Kausar

3. Dr. Obaid ur Rehman

DURATION: 2010-2015

LOCATION: Farmer'sField at Muqam

METHODOLOGY: Treatments

T_1= Control (Untreated)

T_2= Qemisoyl @ 100g plant^{-1}

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

Recommended dose of chemicalwas applied/mixed into the soilunder the canopy area of all selected five plants upto depth of 60cm.

Recommended fertilizers i.e., NPK @ 500 -250 -250 g plant^{-1}were added.

Soil analysis:

Soil ECe, pH, Bulk density, O.M, P, K & texture before application of hydrogels and after every year.

Parameters

- Plant Height and Periphery
- No. of Fruits Plant^{-1}
- Fruit Yield
- Economics
- Moisture in soil(Oven dry basis) up to depth 0-60cmat interval of 30 days

Soil Analysis before Application of Hydrogels

Parameter	**Value**
pH	8.1

Bulk Density (g cm^{-3})	1.56
O.M (%)	0.91
EC_e(dS m^{-1})	0.8
P (mg Kg^{-1})	4.1
K (mg Kg^{-1})	84
Soil Texture	Sandy loam

Soil moisture contents periodically (30 days interval) after Hydrogel application

Date	Depth (cm)	Control	Qemisoyl	Soil Magic
		Mean (5 Plants)	Mean(5 Plants)	Mean(5 Plants)
1.10.13	0-15	10.35	13.21	13.11
	15-30	10.22	13.45	13.20
	30-45	10.63	13.90	13.23
	45-60	10.87	14.00	13.40
1.11.13	0-15	9.87	12.74	11.56
	15-30	9.94	12.83	11.63
	30-45	10.00	13.01	11.84
	45-60	10.05	13.13	12.06
1.12.13	0-15	9.66	12.20	11.45
	15-30	9.82	12.34	11.82
	30-45	9.84	12.62	12.00
	45-60	9.94	12.84	12.12
1.1.14	0-15	9.63	12.33	12.22
	15-30	9.76	12.45	12.46
	30-45	10.05	12.68	12.70

	45-60	10.22	13.01	12.94
1.2.14	0-15	9.94	13.02	12.06
	15-30	10.06	13.33	12.33
	30-45	10.22	13.45	12.56
	45-60	10.21	13.68	12.96
1.3.14	0-15	10.09	13.22	13.22
	15-30	10.45	13.84	13.45
	30-45	10.74	13.79	13.63
	45-60	11.06	14.05	13.76

Sr. No	Treatments	No. ofPlants	Av. Plant Height (m)	Avg. Plant Canopy (m)	No. Fruit Plant^{-1}
1	**Control**	5	3.41 ab	11.64	201b
2	**Qemisoyl**	5	3.79 a	12.15	285 a
3	**Soil Magic**	5	3.61 b	12.33	255 ab

EXPERIMENT# 3.2

TITLE

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

BACKGROUND

- 3.7 billion People are prone to hunger and malnutrition due to mineral and vitamins deficiencies because food is grown on degraded soils (Borlaug, 2007).
- Resource poor farmers in rainfed region remove crop residues for fodder and fuel etc.
- Most of soils are extremely low in SOM (< critical level of 1%).
- 30-40 Kg ha^{-1} yr^{-1}, NPK is removed through crop residues removal leading to erosion hazard (Lal, 2008).
- Crop residues removal deteriorate soil quality (Physico-chemical properties, decline in SOC, CEC, infiltration and increase in bulk density) despite the addition of recommended fertilizer inputs and improved crop varieties (Lal, 2008).

OBJECTIVE (S)

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

To evaluate the impact of crop residue addition on 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

SAWCRS 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

1. Bulk Density (Core method)
2. Aggregate Stability (Wet Sieving)
3. Infiltration Rate
4. Saturated Hydraulic Conductivity

Soil Chemical Properties

pH, SOM and NPK

Cropping System

1. Wheat - Fallow
2. Fallow - Mung
3. Wheat - Mung

Crop Yield

Grain & Straw yield

Previous Year Results

New Experiment

THEME # 4

WATER PRODUCTIVITY

EXPERIMENT# 4.1

TITLE	**ASSESSMENT AND ENHANCEMENT OF WATER PRODUCTIVITY OF ARABLE VS HIGH VALUE CROPS USINGSUPPLEMENTARY IRRIGATION**
OBJECTIVES	To quantify the comparative benefits of use of stored water for high value crops vs. arable crops.
RESEARCH WORKER (S)	1. Mrs. Rahina Kausar(PI) 2. Mr. Muhammad Imran Akram 3. Dr. Obaid ur Rehman
DURATION	2005-2015
LOCATION	Hafizabad (Two sites)
TREATMENTS/METHODOLOGY	
	1. Arable crops (Wheat / fodder) 2. High value crops (Citrus with intercropping of vegetables)
	Observations & data collection

- Water applied to each treatment(70 L x 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 using stored water for high value cops vs. arable crops

Mr. Altaf Hussain, Hafizabad

	Arable crops	**High Value crops**	
	Wheat	**Citrus**	**Berseem**
Area	1 acre	1 acre	6 kanal
Grain yield	23 monds	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=41560**		

- **All the yield data reported here is provided by the farmer**

Mr. Noor Muhammad Hafizabad

	Arable crops	**High Value crops**				
	Wheat	**Citrus**	**Garlic**	**Carrot**	**Spinach**	**Radish**
Area	1 acre	1 acre	-			
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**		

- **All the yield data reported here is provided by the farmer**

July 13	Aug	Sep	Oct	Nov	Dec	Jan14	Feb.	March	April	May	June	Total	Ave
129	136	0	0	7	0	0	32	67	13	27	16	**427**	**35.7**

Rainfall (mm) at study sites

Experiment # 4.2

TITLE

FATE OF PHOSPHATIC FERTILIZERS UNDER DIFFERENT RAINFALL REGIMES OF THE RAINFED REGION

BACKGROUND

Soil erosion is a problem that imposes both on-and off-farm costs. As soil erodes, valuable moisture and nutrients are lost and the topsoil becomes increasingly shallow. Fresh water scarcity is not limited to the arid climate regions only but in areas with good supply the access of safe water is becoming critical problem. Lack of water is caused by low water storage capacity, low infiltration, larger inter annual and annual fluctuations of precipitation (due to monsoon rains) and high evaporation rate.

Considering the fact, fertilizer inputs use and efficiency assumed to be variable in different climatic conditions and on the basis of their sources particularly the phosphatic fertilizers. Farm based research is needed to evaluate the fertilizer use efficiency in different agro-ecological tracts.

OBJECTIVE (S)

Evaluation of fertilizer use efficiency of different phosphatic

fertilizers sources under different moisture and rainfall regimes

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 nutrientswill be applied as basal dose with the recommended rate (NPK @ 46-34-25 Kg Ac^{-1}) and source of nitrogen and potash will beurea and SOP. Wheat will be sown in Rabi.

Rainfall Measurement

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

Soil Analysis

Soil samples will be collected and analyzed for:

i. Saturation % and Soil moisture contents (Before sowing)
ii. P (at month interval after sowing)

Crop Analysis

1. Straw yield (Kg ha^{-1})
2. 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

Results Rabi 2013-14

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	2213	1939	1818	**1990 c**
DAP	3614	3028	2630	**3091 a**
SSP	3047	2407	2043	**2499 b**
NP	3416	2939	2242	**2865 ab**
Mean	**3073 a**	**2578 b**	**2183 b**	

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

Treatments	High Rainfall	Medium Rainfall	Low Rainfall	Mean
Control	2659	2214	1984	**2286 c**
DAP	4332	3454	2879	**3555 a**
SSP	3659	2741	2236	**2879 b**
NP	4100	3357	2448	**3302 a**
Mean	**3688 a**	**2941 b**	**2387 c**	

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

Treatments	Low Rainfall Zone				Medium rainfall Zone				High Rainfall Zone			
	Pre	30 DAS	60 DAS	Post Har	Pre	30 DAS	60 DAS	Post Har	Pre	30 DAS	60 DAS	Post Har

	Sow				Sow				Sow			
Control	3.8	3.6	3.5	3.5	3.8	4.0	3.6	3.6	4.2	4.3	4.0	3.9
DAP	4.0	5.1	4.8	4.4	4.0	4.8	5.0	4.6	4.3	5.4	5.0	5.1
SSP	4.1	4.2	4.3	4.3	3.6	4.2	4.6	4.7	4.2	4.4	5.1	5.4
NP	3.6	4.6	4.4	4.3	3.7	4.2	4.6	4.3	4.2	4.3	5.0	4.5

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

Treatments	High rainfall zone	Medium rainfall zone	Low rainfall zone
Control	22	20	17
DAP	26	21	22
SSP	23	19	19
NP	24	20	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	0.81	0.70	0.70
DAP	0.90	0.76	0.74
SSP	0.87	0.78	0.72
NP	0.88	0.75	0.73

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

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, Mr. Hafiz Abdul Rauf & 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 during Rabi 2013-14.
- Major displacement of stones was not observed October, 2013 till May, 2013.
- Natural grass growing in these structures has strengthened the structures.
- Farmers have shown interest in the installation and continuation of Farm Water control Structures.

CROP YIELD RABI-2013-14 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	3122	2921	3290	3159
R2 (Khabal)	Wheat	2753	2670	4089	3887
R3 (DMJ)	Wheat	3111	3017	3527	3300
Mean		**2995**	**2869**	**3635**	**3448**

1.2 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	Mr. Kashif Bashir, Dr. Adnan Umair & Dr. Rizwan Khalid
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**

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:

AVERAGE BIOMASS YIELD, PLANT HEIGHT AND SPREADING OF VARIOUS GRASSES FOR RABI 2013-14.

S.No	Grass Species	Av. Height /Plant (m)	Av. Periphery (m)	Biomass yield (t/ha)

1	Khavi	0.88	0.23	0.78
2	Madhana	1.59	0.37	1.49
3	Palwan	0.75	0.49	0.46
4	Lemon	0.50	0.66	11.68
5	Mott	2.02	1.57	45.02
6	Khabbal	0.33	0.35	8.04
7	Kai	1.24	0.90	11.68
8	Suryala	0.78	0.61	7.46
9	Vetiver (khaskhas	0.99	0.52	5.05
10	Chingan	1.42	0.52	11.46
11	Babbar	0.82	0.46	1.48

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	**348** October 2013 to May, 2014.	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-2013-14.					
			Biomass yield (t/ha)		
No. of storm	Rainfall (mm)	Slope Gradients	Gram	Lentil	Wheat
5	**348** October 2013 to May, 2014.	1 %	3.55	3.73	3.9
		5%	3.44	3.48	3.27
		10%	3.32	2.57	2.86
		Mean	3.43	3.26	3.34

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, 2013-14.

	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)	536	187 dozens	150	50
Income (Rs)	15008	2805	8250	450
Expenditure (Rs.)	900	550	1000	95
Net Income (Rs.)	14108	2255	7250	355
Income (**Rs/ha**)	99130	120266	145000	4370
Expenditure (**Rs/ha**)	5930	29333	19759	1443
Net Benefit (**Rs/ha**)	93200	90933	125241	2927
Difference	219101-93200= 125901			

4.2 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	Plant height	Canopy diameter
T1	57.94	460.26	325.52
T2	51.2	468.78	275.56

T3	57.92	480.98	312.1

NEW EXPERIMENTS

EXPERIMENT # 01	**SEED PRIMING THROUGH PHOSPHATIC FERTILIZERS IMPACT ON FERTILIZER USE EFFICIENCY.**
Importance	In rainfed agriculture there occurs a poor and erratic crop stands due to moisture stress, poor quality seed of low vigor, viability and purity, untimely crop sowing hinders the optimum plant population and high yield in many field crops such as wheat, maize and millet under normal as well adverse soil condition. Seed priming is a doable technology and its farmer's field appraisal has shown to improve the crop stand and yield performance in wheat under late sown condition, direct seeded rice and spring planted maize.
Objective	To determine the better seed priming source for the improvement in usage of fertilizers.
Research workers	Mr. Hafiz Abdul Rauf & Mr. Kashif Bashir
Duration:	2014-2018
Location:	Sohawa, Jhelum
Methodology	**Main Plots:** 1. Control 2. Half Recommended NPK Dose 3. Full Recommended NPK Dose **Sub Plots:** 1. KH_2PO_4 2. DAP 3. Water Wheat will be sown during Rabi. **Parameters:** No. of Plants per m^2, No. of tillers per plant, Plant Height, Spike Length, No. of spikelets per spike, Biomass yield and Grain yield and Fertilizer Use Efficiency.
Previous Year's Results	First year

EXPERIMENT # 02 **DISTRIBUTION OF CARBON WITHIN DRY AGGREGATES IN DIFFERENT TEXTURED SOILS OF SOHAWA**

Importance

Soil carbon status plays an important role in ecosystems by retaining and supplying plant nutrients, improving soil aggregation, reducing soil erosion, and enhancing water holding capacity. The data regarding distribution of carbon within soil aggregates is unavailable in this area. This data will help in planning and executing the soil and water conservation experiments with better approach.

Objective

To determine carbon associated with different sized aggregates in cultivated and uncultivated soils.

Research workers

Mr. Mehboob Ali Mujahid & Mr. Kashif Bashir

Duration:

2014-2016

Location:

Sohawa, Jhelum

Methodology

Type of soils:

1. Cultivated
2. Uncultivated

Aggregate Fractions:

06 different sized fractions

No. of Soil Textures:

10 Different Soil Textures

Parameters:

1. Dry Aggregate Size Distribution
2. Mean Weight Diameter of Dry Aggregates
3. Carbon Distribution in Different Sized Aggregates

Previous Year's Results

First year