ANNUAL PROGRAMME OF RESAERCH WORK

FOR THE YEAR

2018-19

OF

BIOCHEMISTRY SECTION
POST HARVEST RESEARCH CENTRE
FAISALABAD

Introduction

This section conducts research relating to nutritional quality evaluation of promising lines / varieties of grain crops, fruits, vegetables and fodder crops, utilization of agro-industrial wastes as plant nutrient source and soil improver for enhancing productivity of crops, effect of fertilization on quality of crops and soil health for improving plant nutrition and also determining toxicants/anti-nutritional factors in different fodder crops. In addition analytical facility for the quality assessment (proximate analysis) of products/varieties of crop specialists and various institutions of AARI, Faisalabad is carried out as per their requirements.

During the year 2018-19 research will be carried out on nutritional quality of brinjal, carrot, sweat Pea, alvi, brocoli, sweat potato, sugar beet, turnip, spinach, peas, bitter gourd, tomato, okra, grapes, plum, qunioa, moringa, lucern, maize, sorghum, pearl millet, rhode grass, berseem, oat and rye grass. Effect of fertilization on quality of wheat and gram, effect of cooking time on quality of vegetables, effect of climate change on quality of wheat flour, antioxidant potential of kiwi, pineapple, sweat lemon and karunda. Effect of microbial inoculation on quality of mung bean and mash, effect of biostimulants on quality of wheat and rice.

Staff position

S. No.	Name of Post	Filled	Vacant	Total
1	Agricultural Chemist (Bio)	1	-	1
2	Assistant Agriculture Chemist	1	-	1
3	Assistant Research Officer	5	-	5

Break up of experiments

i. Ongoing = 10
ii. New = 08
iii. Total = 18

CONTENTS

TITLE- 1	**ASSESSMENT OF ANTIOXIDANT AND NUTRITIONAL POTENTIAL OF DIFFERENT FRUITS AND VEGETABLES**
IMPORTANCE	• Antioxidants reduce the risk for chronic diseases including cancer and heart disease. • Fruits and vegetables are widely recommended for their health-promoting properties because of their higher concentrations of vitamins C and A, antioxidants and source of dietary fiber.
OBJECTIVE	• That is why the present study is planned to determine the antioxidants potential of different fruit and vegetables.
RESEARCH WORKERS	Dr. Naseem Akhtar, Nisar Ahmad and Khalid Hussain
DURATION	Continuous
LOCATION	Biochemistry Section AARI, Faisalabad.
TREATMENTS	**Fruits** 1. Kiwi 2. Pineapple 3. Sweet lemon 4. Kuranda **Vegetables** 1. Arvi 2. Broccoli 3. Sweet potato 4. Sugar beet
METHODOLOGY	Fifteen samples each of fruit and vegetable will be collected from local market. Fresh juice of fruit samples will be extracted and used for determination of Vitamin- C, total anti oxidants and total phenol contents and total carotenoide. Fresh weight of vegetables will be noted and samples will be oven dried, weighted for dry matter and ground for determination of total anti oxidants, total phenols, crude fats, crude protein, Crude fiber, Nitrogen Free Extract (NFE), Mineral matter.
PREVIOUS YEAR'S RESULTS	New Experiment

TITLE-2	**NUTRITIONAL QUALITY EVALUATION OF DIFFERENT PLUM (*Prunus domestica*) VARIETIES**
IMPORTANCE	Plum (*Prunusdomestica* L.) is a temperate zone fruit crop, which belongs to the genus *Prunus* of subfamily *Amygdaloideae* (syn. *Prunoidae*), family *Roseaceae* (Potter et al., 2007). Plums have abundance of bioactive compounds such as phenolic acids, organic acids, (e.g., citric and malic acids), minerals (e.g., potassium, phosphorus, calcium and magnesium). Plum (*Prunusdomestica*) is an important stone fruit after peach in terms of area and production in Pakistan. The color of the outer skin may vary considerably from yellow or dark red to purple or black. Plums are an excellent source of vitamins such as vitamin A, C (ascorbic acid).
OBJECTIVES	This study is designed to evaluate the nutritional quality of different plum varieties grown in Punjab.
RESEARCH WORKERS	Maryam Sarfraz, Nisar Ahmad, Khalid Hussain
DURATION	2018-21
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad in collaboration with Horticultural Research Station, Nowshera (Soon Valley) Khushab
TREATMENTS	**Varieties** 1. FazaliManani 2. Methlay 3. Santa Rosa 4. Faetha 5. Fruit available in market
METHODOLOGY	Ten samples of each plum variety (approximately one kg) will be collected from Horticultural Research Station, Nowshera Soon Valley Khushab during the month of May 2019. Data regarding fresh weight, peel %, stone weight and pulp % will be recorded. Juice will be extracted and analyzed for ascorbic acid; sugars total phenols TSS, pH, acidity citric acid, malic acid, beta carotene, antioxidant activity firmness, potassium, calcium and magnesium.
PREVIOUS YEAR'S RESULTS	New experiment

<table>
<tr><td>TITLE-3</td><td>QUALITY COMPARISON OF CARROT AND SWEET PEA GROWN IN SPECIFIC AREAS WITH THOSE GROWN IN SCATTERED AREAS OF FAISALABAD</td></tr>
<tr><td>IMPORTANCE</td><td>

Vegetables are the fresh and edible portions of herbaceous plants
Dietary fiber from vegetables helps reduce blood cholesterol levels and may lower risk of heart disease
Carrot improves eyesight and prevents night blindness as it contains carotene
Peas lower cholesterol levels and blood sugar regulation in the body
It is the trend that people concentrate to grow specific vegetables such as carrot (grow in Manawala area) and peas (grow in Shahkot area)

</td></tr>
<tr><td>OBJECTIVE</td><td>Therefore the study is planned to compare the nutritional quality of vegetables grown in specific area with those grown in scattered area</td></tr>
<tr><td>RESEARCH WORKERS</td><td>Dr. Naseem Akhtar, Nisar Ahmad and Khalid Hussain</td></tr>
<tr><td>DURATION</td><td>2018-2020</td></tr>
<tr><td>LOCATION</td><td>Farmer fields of Shahkot, Mananwala, Tehsil Faisalabad and Agronomic Research Institute, Faisalabad</td></tr>
<tr><td>TREATMENTS</td><td>
<table>
<tr><th>Vegetables</th><th>Area 1</th><th>Area 2</th></tr>
<tr><td>Carrot</td><td>Villages of Manawala</td><td>Villages of Tehsil Faisalabad</td></tr>
<tr><td>Sweet pea</td><td>Villages of Shahkot</td><td>Villages of Tehsil Faisalabad</td></tr>
</table>
</td></tr>
<tr><td>METHODOLOGY</td><td>Vegetable samples will be collected from farmer fields of specific areas of Tehsil Faisalabad & Vegetables (carrot and sweet pea) samples should be collected from Vegetables and Agronomic Research Institute, Faisalabad during summer and winter season. Soil sample will also be collected for physic-chemical analysis. Fresh weight of vegetables will be noted and samples will be oven dried, weighed for dry matter and ground for determination of zinc, beta carotene, crude fat, Crude Protein, Crude Fiber, Nitrogen Free Extract (NFE) and Mineral matter.</td></tr>
<tr><td>PREVIOUS YEAR’S RESULTS</td><td>New Experiment</td></tr>
</table>

TITLE-4	**NUTRITIONAL EVALUATION OF MORINGA (*Moringa oleifera*) LEAVE AND ITS COMPARISON WITH ORHER CONVENTIONAL FODDERS**
IMPORTANCE	*Moringaoleifera* a member of the family Moringaceae, widely available in the tropical and subtropical regions. It is a fast growing plant of great economic importance for the food and medical industries. It is used as vegetable and also in Indian folk medicine for the treatment of various illnesses. Leaves of *Moringaoleifera* are a rich source of proteins but contain less carbohydrates and lipids. Contain more ascorbic acid and their leaves are a good dietary source for calcium, magnesium, manganese and copper.
OBJECTIVES	This study is planned to compare the nutritional value of Moringa leave with other conventional fodder used for livestock.
RESEARCH WORKERS	Maryam Sarfraz, Nisar Ahmad, Khalid Hussain
DURATION	2018-21
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad in collaboration with University of Agriculture, Faisalabad and Fodder Research Station, AARI, Faisalabad
TREATMENTS	**Conventional Fodder Crop** **Kharif** — **Rabi** Maize — Berseem Sorghum — Lucern Pearl Millet — Oat
METHODOLOGY	Samples (approximately 500 g) of each selected conventional fodder crop will be collected from Fodder Research Station and Moringa leaves from University of Agriculture, Faisalabad. Fresh weight will be noted and samples will be oven dried, weighted for dry matter and ground for determination of dry matter, ash, crude fat, crude protein, crude fiber, carbohydrates, calcium, magnesium, copper, manganese, antioxidant activity, chlorophyll a, b, phytic acids and total carotenoid.
PREVIOUS YEAR'S RESULTS	New Experiment

<table>
<tr><td>TITLE- 5</td><td>EVALUATION OF NUTRITIONAL STATUS OF DIFFERENT RABI AND KHARIF FODDERES</td></tr>
<tr><td>IMPORTANCE</td><td>Fodder crops are the main and cheapest source of feed for livestock. However, shortage of fodder production and not having balanced nutrition is the major limiting factor for livestock production in our country.</td></tr>
<tr><td>OBJECTIVES</td><td>Present study is designed to analyze nutritional status of different Rabi and Kharif fodder crops to get best result from farming animals/cattle in the form of milk or meat as more than half of animal feed source is fodder.</td></tr>
<tr><td>RESEARCH WORKERS</td><td>M. Abubakar Siddique, Nisar Ahmad and Khalid Hussain</td></tr>
<tr><td>DURATION</td><td>2018-21</td></tr>
<tr><td>LOCATION</td><td>Biochemistry Section, PHRC, AARI, Faisalabad in collaboration with Fodder Research Sub-Institute AARI, Faisalabad.</td></tr>
<tr><td>TREATMENTS</td><td>General varieties/crops
<table>
<tr><th>Rabi Fodders</th><th>Kharif Fodders</th></tr>
<tr><td>Lucern</td><td>Sorghum</td></tr>
<tr><td>Berseem</td><td>Maize</td></tr>
<tr><td>Oat</td><td>Pearl Millet</td></tr>
<tr><td>Rye Grass</td><td>Rhode grass</td></tr>
</table></td></tr>
<tr><td>METHODOLOGY</td><td>Selected Rabi and kharif fodders will be collected from fodder research sub-institute, AARI, Faisalabad during Rabi and Kharif season. The sample will be collected at tesseling stage (when the fodder will be ready for grazing). Fodder samples will be analyzed for dry matter, crude protein, crude fiber, mineral mater, NFE and crude fat.</td></tr>
<tr><td>PREVIOUS YEAR'S RESULTS</td><td>New Experiment</td></tr>
</table>

TITLE- 6	**ENHANCEMENT OF PROTEIN CONTENTS IN GRAM BY FERTILIZERS MANAGEMENT**
IMPORTANCE	Pulses has important role in contributing to food and nutritional security and replenishing soil nutrients having a huge potential in addressing needs like future global food security, nutrition and environmental sustainability needs. Pulses are rich in proteins and found to be best and cheap source of protein. Gram is also high in fiber, as well as a significant source of iron, zinc, potassium and magnesium. By keeping in view the above importance of pulses in human diet, the present study has been planned.
OBJECTIVES	1- To evaluate the nutritional composition of selected varieties of gram (chickpea) grown by addition of various treatments. 2- To find out the best combination of fertilizer for high protein harvest from gram.
RESEARCH WORKERS	M. Abubakar Siddique, Nisar Ahmad and Khalid Hussain
DURATION	2018-21
LOCATION	Biochemistry Section with collaboration of Pulses Research Institute Faisalabad.
TREATMENTS	T_1-Control T_3- N (30 kg/ha) T_5-P (90 kg/ha) T7-K (30 kg/ha) T_9-NPK (30+90+30) kg/ha with T_2-Control with inoculums T_4-N (30 kg/ha) with inoculum T6- P (90 kg/ha) with inoculum T8- K (30 kg/ha) with inoculum T10- NPK (30+90+30) kg/ha inoculums
METHODOLOGY	A field experiment will be conducted in field. During the Rabi season gram will be sown. Fertilizer will be applied according to the treatment mentioned above. Crop management practices will be adopted according to the production technology. Grain yield will be recorded at time of harvesting. Samples will be collected from each treatment, dried, ground and analyzed for dry matter, crude protein, crude fat, crude fiber, ash, NFE, Zn and Fe.
PREVIOUS YEAR'S RESULTS	New Experiment

TITLE-7	**INFLUENCE OF BIOCHAR APPLICATION ON NUTRITIONAL QUALITY CHARACTERISTICS OF TOMATO UNDER DROUGHT STRESS**
IMPORTANCE	• Tomatoes are one of the most nutritionally and economically important crops around the world. • Tomatoes require large amount of water to grow well and are adversely affected by drought stress • Pakistan is facing serious water shortage issue and crisis is round the corner • Application of biochar significantly improves the secondary metabolites and antioxidant activity
OBJECTIVE	The experiment is designed to check the effect of biochar on nutritional quality parameters of tomato under drought stress
RESEARCH WORKERS	Waqar Ahmad, Nisar Ahmad and Khalid Hussain
DURATION	2018-2020
LOCATION	Biochemistry Section, Post Harvest Research Centre, AARI, Faisalabad
TREATMENTS	Field Capacity Levels 1. 50% of field capacity 2. 60% of field capacity 3. 70% of field capacity 4. Field Capacity Biochar Amendment 1. 1% w/w 2. 2% w/w Layout Plan CRD Factorial No. of Treatments: 8 No. of Replications: 4
METHODOLOGY	Pot experiment will be conducted at Biochemistry Section, PHRC, Faisalabad. Tomato nursery will be transplanted in pots. Biochar amendments at the rate mentioned above will be mixed with soil before pot filling. Field capacity at described levels (70, 60 and 50% of field capacity) will be maintained throughout the experiment period. Tomatoes will be harvested when ripe Nutritional quality parameters (lycopene, total phenolic contents, antioxidant activity, chlorophyll contents will be determined after harvesting.
PREVIOUS YEAR'S RESULTS	New Experiment

TITLE-8	**EFFECT OF SOWING TIME ON GROWTH AND NUTRITIONAL QUALITY OF WHEAT**
IMPORTANCE	• Changing climate is affecting crops quality. • Abrupt change in temperature and humidity during growth period may affect the yield as well as quality of crops.
OBJECTIVES	• A study is therefore planned to see the effect of temperature and humidity variation during growth period of wheat on its flour quality.
RESEARCH WORKERS	Muhammad Abubakar Siddique, Nisar Ahmad and Khalid Hussain
DURATION	2017-20
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad
TREATMENTS	**Sowing times of wheat** 20 Oct, 01-Nov,10-Nov,20-Nov,01-Dec,10-Dec,20-Dec,01-Jan,10-Jan &20-Jan
METHODOLOGY	Wheat will be sown in field according to treatment plan with recommended fertilizer dose (NPK 120-90-70kg ha^{-1}) with plot size 1m x1m in RCBD with three replications. Variety will be galaxy. All the agronomic practices will be kept uniform. Seed rate will be 100 kg ha^{-1}. At harvesting, samples will be collected from each plot and analyzed for crude protein, crude fat, total minerals, fiber contents and NFE. During growing season temperature and humidity will be recorded on daily basis.
PREVIOUS YEAR'S RESULTS	New Experiment

<table>
<tr><td>TITLE-9</td><td>EVALUATION OF QUALITY DIFFERENCES IN VEGETABLES GROWN IN TUNNELS (OFF SEASON) AND IN FIELD (ON SEASON)</td></tr>
<tr><td>IMPORTANCE</td><td>• Vegetables tunnel farming has become a growing phenomenon in Pakistan.
• High produce and big returns motivated the farming community to enter into tunnel farming business.
• To get higher yield more inputs are used</td></tr>
<tr><td>OBJECTIVES</td><td>• Keeping in view these circumstances, it is imperative to compare the nutritional quality of vegetables, grown under tunnel and field condition</td></tr>
<tr><td>RESEARCH WORKERS</td><td>Dr. Naseem Akhtar, Nisar Ahmad and Khalid Hussain</td></tr>
<tr><td>DURATION</td><td>2016-19</td></tr>
<tr><td>LOCATIOHN</td><td>Farmer fields</td></tr>
<tr><td>TREATMENTS</td><td>T1: Off season summer vegetables (Cucumber, Bitter gourd)
T2: On season summer vegetables (Cucumber, Bitter gourd)
T3: Off season winter vegetables (Tomato, Bell Pepper)
T4: On season winter vegetables(Tomato, Bell Pepper)</td></tr>
<tr><td></td><td>Vegetable samples will be collected from farmer fields of Faisalabad from tunnels as well as field area. Fresh weight will be noted and samples will be oven dried, weighted for Dry matter and ground for determination of crude fats, crude protein, Crude Fiber, Nitrogen free Extract (NFE) and Mineral matter. The following sowing/harvesting plan will be followed
<table>
<tr><td>Name of vegetables</td><td></td><td>Name of vegetables</td><td></td><td>Name of vegetables</td></tr>
<tr><td>Cucumber</td><td></td><td>Cucumber</td><td></td><td>Cucumber</td></tr>
<tr><td>Bitter gourd</td><td></td><td>Bitter gourd</td><td></td><td>Bitter gourd</td></tr>
<tr><td>Tomato</td><td></td><td>Tomato</td><td></td><td>Tomato</td></tr>
<tr><td>Bell Pepper</td><td></td><td>Bell Pepper</td><td></td><td>Bell Pepper</td></tr>
</table></td></tr>
<tr><td>PREVIOUS YEAR’S RESULTS</td><td>Page-13</td></tr>
</table>

Physicochemical parameters of cucumber, tomato, teendi and bitter gourd grown in tunnels.

Vegetables	Moisture (%)	Fat (%)	Fiber (%)	Protein (%)	Ash (%)	NFE (%)
Cucumbr	95.59 a	0.45 b	3.74 c	0.56 c	3.85 c	91.36 a
Tomato	95.19 a	1.41 a	6.13 b	0.78 b	5.91 b	85.73 c
Teendi	93.00 c	0.37 bc	5.84 b	0.76 b	6.34 b	86.67 b
B gourd	94.19 b	0.32 c	9.61 a	1.15 a	10.12 a	78.78 d
CV	1.32	23.94	10.79	15.38	12.98	1.14
LSD	0.8322	0.1027	0.4576	0.0842	0.5696	0.6538

Physicochemical parameters of cucumber, tomato, teendi and bitter gourd grown naturally (On season).

Vegetables	Moisture (%)	Fat (%)	Fiber (%)	Protein (%)	Ash (%)	NFE (%)
Cucumbr	94.14 a	0.52 b	4.73 c	0.44 d	4.54 d	89.77 a
Tomato	93.79 ab	0.66 a	6.61 b	0.65 c	6.37 c	85.7 b
Teendi	92.26 c	0.45 c	6.50 b	0.75 b	7.34 a	84.96 c
B gourd	93.27 b	0.36 d	7.54 a	0.85 a	6.99 b	84.23 d
CV	0.98	5.89	4.87	6.61	7.01	0.64
LSD	0.6134	0.0197	0.2067	0.0299	0.2960	0.3717

Conclusion

Samples were analyzed and it was concluded that all the four vegetables showed different nutritional composition during on and off season. Cucumber has higher percentage of fat fiber and ash during on-season while carbohydrates and protein was higher during off season. Fat and protein was higher in off season tomato while it has higher percentage of fiber and ash during on-season. Teendi has higher percentage of fat, fiber, protein and ash during on- season and carbohydrates were higher during off season. Bitter gourd has higher percentage of fat and carbohydrates during on-season while protein fiber and ash were higher during off season.

TITLE-10	**NUTRITIONAL QUALITY EVALUATION OF DIFFERENT GRAPES VARIETIES**
IMPORTANCE	• Grapes are an excellent source of vitamin C, total phenols and tartaric acid. • Grapes are a rich source of micronutrient minerals, copper, iron and manganese. • Farmers have started the growing of grapes as a commercial commodity.
OBJECTIVES	• Present study is designed to evaluate the nutritional quality of different grapes varieties.
RESEARCH WORKERS	Maryam Sarfraz, Nisar Ahmad, Khalid Hussain and Muhammad Aqeel Feroze
DURATION	2017-20
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad in collaboration with Barani Agriculture Research Institute, Chakwal
TREATMENTS	**Varieties** 1. Kings ruby 2. Flame seedless 3. Vitro black 4. Sultanina-C 5. Chasselas 6. Priest 7. Superior 8. Muscat hambourg 9. Danlas 10. Sunder khani
METHODOLOGY	Fresh grapes samples (approximately half kg) of each selected varieties of grapes will be collected from Grapes Garden of Barani Agriculture Research Institute, Chakwal during the month of July. Juice will be extracted and analyzed for ascorbic acid (Vitamin C), tartaric acid, total phenols, β-carotene, TSS, sugars, copper, iron and manganese.
PREVIOUS YEAR'S RESULTS	Page-15

Chemical composition of different grapes varieties

Variety	Vitamin C (mg/100g)	Phenols (µg GAE/ml)	Cu (ppm)	Fe (ppm)	Beta carotene (µg/100g)
Muscat	3.31 cd	479.2 cd	11.9 d	63.7 g	41.9 h
Superior	3.23 cd	358.4 f	6.08 g	130.2 a	45.9 f
Sultanina C	3.92 b	554.5 a	13.6 c	75.5 f	55.7 c
Danlas	3.19 cd	510.3 b	4.38 h	76 ef	47.7 e
Chasselas	4.25 a	489.5 bc	9.23 f	96.1 c	43.9 g
Vitro black	3.24 cd	474.7 cd	14.1 b	77.2 e	60.2 a
Kings ruby	3.16 d	454.9 d	14.7 a	98.9 b	51.2 d
Flame seedless	3.35 c	482 bcd	9.84 e	130.7 a	57.3 b
Priest	3.28 c	405.3 e	14.1 b	84 d	55.2 c
CV	5.44	6.09	2.84	1.80	2.64
LSD	0.187	28.5	0.308	1.67	1.345

Chemical composition of different grapes varieties

Variety	TSS	Tartaric Acid (%)	Reducing sugar (%)	Total sugar (%)	Non reducing sugar (%)
Muscat	19.9 a	0.45 d	13.1 a	19.0 a	5.62 de
Superior	8.3 e	0.45 d	7.36 d	12.2 f	4.63 f
Sultanina C	16.3 c	0.64 c	5.48 f	12.5 e	6.66 bc
Danlas	18.6 b	0.30 e	7.08 d	13.4 d	5.98 d
Chasselas	18.3 b	0.31 e	4.88 g	12.1 f	6.83 b
Vitro black	11.9 d	0.70 b	11.6 b	17.4 b	5.49 e
Kings ruby	16.3 c	0.41 d	12.9 a	17.4 b	4.21 g
Flame seedless	11.7 d	0.42 d	6.35 e	15.5 c	8.69 a
Priest	19.6 a	0.94 a	10.8 c	17.5 b	6.41 c
CV	3.61	5.63	3.35	1.34	5.99
LSD	0.98	0.05	0.29	0.204	0.36

CONCLUSION:

It is concluded that TSS ranged from 8.3 to 19.9 % (Maximum 19.9%), reducing sugar ranged from 4.88 to 13.1% (maximum 13.1%) and Total sugar ranged from 12.2 to 19.0% (maximum 19.0%) in variety Muscat hambourg.

TITLE-11	**CHEMICAL COMPOSITION OF ALOE VERA WITH RESPECT TO SEASONAL VARIATION**
IMPORTANCE	• The Aloe vera(*Aloe barbadensis miller)*plant has been known and used for centuries for health, beauty and medicinal properties. • The Egyptians called Aloe "the plant of immortality."
OBJECTIVES	• Keeping in view the importance of aloe vera present study is planned to evaluate the quality of the leaves of aloe vera.
RESEARCH WORKERS	Maryam Sarfraz, Nisar Ahmad and Khalid Hussain
DURATION	2015-18
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad.
TREATMENTS	**Sampling Time** 1. January 2. April 3. July 4. October
METHODOLOGY	Five samples of Aloe vera will be collected from pots at an interval of three months starting from January, 2017 and analyzed using CRD for quality parameters. Fresh plant leaves will be used to determine gel (%), peel (%) and fresh gel will be used to record pH, Vitamin C and TSS. Plant leaves will be cut into slices and oven dried plant sample will be used to record data regarding Dry matter, Crude protein, Crude fat, Ash, Crude fiber, NFE, Calcium, Copper, Zinc and Iron.
PREVIOUS YEAR'S RESULTS	Page-17

Chemical composition of aloe vera samples collected during July, 2017

Plots	Gel %	Peel %	TSS	pH	Ash %	Crude Fat (%)	Crude Protein (%)	Crude Fiber (%)	NFE (%)	Fe (ppm)	Zn (ppm)
Aloe vera Plot 1	63.6 c	36.4 b	1.37 a	4.52 ab	0.14 a	0.21 e	14.8 b	0.13	84.8 b	111 b	39.7 a
Aloe vera Plot 2	61.4 d	38.6 a	1.13 b	4.48 bc	0.15 a	0.49 c	13.5 c	0.12	85.8 a	103 bd	34.7 a
Aloe vera Plot 3	61.5 d	38.5 a	1.30 a	4.45 c	0.12 a	0.45 d	14.8 b	0.12	84.5 b	124 a	27 ab
Aloe vera Plot 4	69.3 a	30.7 d	1.23 a	4.54 a	0.13 a	0.55 b	15.4 a	0.13	83.8 c	95 c	18.7 b
Aloe vera Plot 5	67.3 b	32.7 c	1.23 a	4.51 ab	0.14 a	0.64 a	14.4 b	0.13	84.7 b	135 a	32.7 a
CV	1.44	2.63	4.19	0.49	12.4	5.18	2.12	NS	0.40	5.30	24
LSD	1.75	1.75	0.097	0.042	0.031	0.045	0.58		0.63	11.3	13.8

Chemical composition of aloe vera Samples collected during October, 2017

Plots	Gel %	Peel %	TSS	pH	Dry Matter (%)	Ash %	Crude Fat (%)	Crude Protein (%)	Crude Fiber (%)	NFE (%)	Fe (ppm)	Zn (ppm)
Aloe vera Plot 1	60.6 c	39.4 a	1.13	5.04 c	2.84 c	0.14 ab	0.21 e	14.5 bc	0.11 b	85 a	117.7 b	34.3 b
Aloe veraPlot 2	69 a	31.0 c	1.03	5.08 b	2.91 a	0.16 a	0.51 c	14.1 c	0.13 ab	85.1 a	105.7 c	32.1 c
Aloe vera Plot 3	60.8 bc	39.2 ab	1.17	5.06 c	2.88 abc	0.11 c	0.45 d	14.4 c	0.13 ab	84.9 a	144 a	30.5 d
Aloe vera Plot 4	61 bc	39.0 ab	1.13	5.11 a	2.90 ab	0.14 ab	0.58 b	15.1 a	0.14 a	84.1 b	106 c	38.8 a
Aloe vera Plot 5	61.7 b	38.3 b	1.03	5.09 b	2.86 bc	0.13 b	0.64 a	15.0 ab	0.12 ab	84.1 b	120 b	29.7 d
CV	**0.90**	**1.51**	**NS**	**0.21 0.020**	**1.01**	**8.85**	**5.97**	**1.81**	**7.63**	**0.33**	**3.05**	**1.45**
LSD	**1.06**	**1.06**			**0.054**	**0.02 3**	**0.053**	**0.49**	**0.018**	**0.523**	**6.81**	**0.91**

Chemical composition of aloe vera Samples collected during January, 2018

Plots	Gel %	Peel %	TSS	pH	Dry Matter (%)	Ash %	Crude Fat (%)	Crude Protein (%)	Crude Fiber (%)	NFE (%)	Fe (ppm)	Zn (ppm)
Aloe vera Plot 1	61.6 b	38.4 b	1.03 a	4.47 b	2.82 b	0.17 a	0.25 d	14.8 b	0.15 ab	84.6 b	119.3 c	34.4 b
Aloe vera Plot 2	62.5 a	37.5 c	0.73 b	4.45 c	2.22 c	0.12 b	0.32 c	14.8 b	0.1 c	84.7 b	109.3 d	32.4 c
Aloe vera Plot 3	60.2 c	39.8 a	0.77 b	4.51 a	2.84 b	0.12 b	0.45 b	13.6 c	0.15 a	85.6 a	149.7 a	30.8 d
Aloe vera Plot 4	61.1 b	38.9 b	0.70 b	4.48 b	3.26 a	0.17 a	0.56 a	15.6 a	0.13 b	83.5 c	106.7 d	39.2 a
Aloe vera Plot 5	59.8 c	40.2 a	0.67c	4.41 d	2.90 b	0.19 a	0.63 a	15.6 a	0.15 a	83.4 c	127.3 b	28.9 e
CV	**0.65**	**1.02**	**9.36**	**0.22**	**2.04**	**8.51**	**8.55**	**0.48**	**7.52**	**0.13**	**2.37**	**1.51**
LSD	**0.77**	**0.77**	**0.06**	**0.02**	**0.11**	**0.03**	**0.07**	**0.13**	**0.02**	**0.21**	**5.45**	**0.41**

SUMMARY/ CONCLUSION

Sampling Months	Gel %	Peel %	TSS	pH	Ash %	Crude Fat (%)	Crude Protein (%)	Crude Fiber (%)	NFE	Fe (ppm)	Zn (ppm)
July 2017	64.62	33.82	1.252	4.5	0.136	0.468	14.58	0.126	84.72	113.6	30.56
October 2017	62.62	37.38	1.098	5.076	0.136	0.478	14.62	0.126	84.64	118.68	33.08
January 2018	61.04	38.96	0.78	4.464	0.154	0.442	14.88	0.136	84.36	122.46	33.14

It is concluded that gel ranged from 61.04 to 64.6% (maximum 64.6%), TSS ranged from 0.78 to 1.252% (maximum 1.25%) and NFE ranged from 84.36 to 84.7% (maximum 84.7%) in aloe vera harvested in July 2017 while peel ranged from 33.8 to 38.96% (maximum 38.9%), crude protein ranged from 14.6 to 14.9% (maximum 14.9%), crude fiber ranged from 0.126 to 0.136% (maximum 0.136%), Fe ranged from 113.6 to 122.5ppm (maximum 122.5ppm) and Zn ranged from 30.6 to 33.14ppm (maximum 33.1ppm) in aloe vera harvested in January 2018

TITLE-12	**EFFECT OF DIFFERENT BIOSTIMULANTS ON THE QUALITY OF WHEAT AND RICE**
IMPORTANCE	• Biostimulant is a substance that is neither a plant nutrient nor a pesticide, but has a positive impact on plant health. • Progressive farmers are using this to increase the yield and growth of rice and wheat.
OBJECTIVES	• This study is therefore planned to see the effect of biostimulants on quality of wheat and rice.
RESEARCH WORKERS	Maryam Sarfraz, Nisar Ahmad and Khalid Hussain
DURATION	2016-18
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad in collaboration with Soil Bacteriology Section, AARI, Faisalabad.
TREATMENTS	**Biostimulant Dose Application method** 1 FactopRice 3ml/kg Seed treatment All CropgroWheat =1.5ml/kg // 2 Prim GR: Wheat & Rice =5kg/acre Soil application 3 Canal Water: Wheat & Rice =9L/acre Soil application 4 BM Plus: Wheat & Rice=2 ml/1kg Seed treatment 5 Basanti: Wheat & Rice=10kg/acre Soil application 6 Sea Maxx: Wheat& Rice=300-500 Foliar application ml/ acre
METHODOLOGY	A Pot study will be conducted at Biochemistry Section, AARI, Faisalabad on rice and wheat according to CRD with four replications. Six bio stimulants will be collected from Soil Bacteriology Section and applied to see the effect on the yield and quality of rice and wheat. Recommended dose of PK will be applied at the time of sowing while N in two splits. At the time of harvesting grain and paddy samples will be collected, dried, ground and analyzed for dry matter, crude protein, crude fiber, crude fat, ash and NFE.
PREVIOUS YEAR'S RESULTS	Page-22

Chemical composition of paddy rice affected by the application of different bio stimulants

Treatments	Moisture (%)	Ash (%)	Crude Fat (%)	Crude Fiber (%)	Crude Protein (%)	NFE (%)
Fertigrain	11.1 a	1.26 a	1.16 f	0.92 a	7.27 b	89.4 d
Rely	10.1 cd	1.15 b	1.24 d	0.78 c	7.75 a	89.1 f
Hook	10.7 ab	1.08 c	1.07 g	0.84 b	7.72 a	89.3 e
Asahi Star	9.88 d	1.18 b	1.21 e	0.84 b	6.82 d	90 a
BM plus	10.6 b	1.26 a	1.56 a	0.81 bc	6.84 d	89.5 c
Sea maxx	9.90 d	1.23 a	1.38 c	0.85 b	7.10 c	89.4 b
Control	10.4 bc	1.23 a	1.51 b	0.84 b	6.76 e	89.7 b
CV	**2.62**	**2.04**	**1.42**	**4.14**	**0.44**	**0.05**
LSD	**0.40**	**0.036**	**0.027**	**0.052**	**0.046**	**0.06**

CONCLUSION

It is concluded that crude protein ranged from 6.76 to 7.75% (maximum 7.75%) in pot where biostimulant Rely was added.

TITLE-13	**COOKING EFFECT ON NUTRITIONAL QUALITY OF VEGETABLES**
IMPORTANCE	• Vegetables are an important part of the human diet and a major source of biologically active substances such a dietary fiber, antioxidant and minerals. • These biologically active substances may lose during cooking.
OBJECTIVES	• The experiment is designed to observe the effect of cooking and cooking period on nutritional quality of vegetables and to find best period /method for cooking.
RESEARCH WORKERS	Ms. Maryam, Sarfraz Nisar Ahmad and Khalid Hussain,
DURATION	2017-20
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad.
TREATMENTS	**Vegetables** Summer season: bitter gourd, pumpkin, cucumber and bottle gourd Winter season: carrots, peas, turnip and cauliflower. **Time duration** 1. Fresh (uncooked) 2. 20 minutes cooking (Boiling100°C) 3. 40 minutes cooking (Boiling100°C) 4. Indian cooking (Home cooking)
METHODOLOGY	Fresh vegetables will be collected from local market/Vegetable Research Institute, Faisalabad. Fresh vegetables (uncooked) will be analyzed for crude protein, crude fat, ash, crude fiber and NFE. Cooking treatments will be applied according to plan. After each treatment application, all the analysis will be repeated. Same parameters will be analyzed for both summer and winter vegetables. Residual water will also be analyzed for above mentioned parameters.
PREVIOUS YEAR'S RESULTS	Page-24

Chemical composition of different vegetables affected by different cooking period

Vegetables	Time Duration	Ash (%)	Crude Protein (%)	Crude Fat (%)	Crude Fiber (%)	NFE (%)
Cucumber	Fresh	8.58	9.31	0.26	1.38	80.4
	20 min cooking	7.49	9.00	0.24	1.96	81.2
	40 min cooking	7.65	8.61	0.20	1.74	81.7
	Indian cooking	6.36	5.36	0.14	1.74	86.3
Bitter gourd	Fresh	5.15	9.45	0.23	3.39	81.9
	20 min cooking	5.09	8.34	0.20	2.55	83.8
	40 min cooking	4.79	7.42	0.22	3.47	84
	Indian cooking	3.08	1.28	0.18	2.71	92.4
Pumpkin	Fresh	6.41	8.14	0.29	1.38	83.4
	20 min cooking	6.29	7.77	0.21	1.77	83.9
	40 min cooking	6.54	7.01	0.20	1.92	84.2
	Indian cooking	4.67	1.11	0.18	2.11	91.8
Bottle gourd	Fresh	4.61	15.83	0.21	2.49	77
	20 min cooking	4.49	13.47	0.25	2.41	79.6
	40 min cooking	4.44	11.87	0.23	2.20	81.5
	Indian cooking	3.46	2.20	0.17	2.03	92.4

CONCLUSION

It is concluded that overall cooking has bad effect on ash content, crude fat and crude fiber while protein contents decreases with increasing boiling time in all vegetables.

<table>
<tr><td>TITLE-14</td><td>EFFECT OF PHOSPHORUS ON NUTRITIONAL QUALITY AND YIELD OF WHEAT</td></tr>
<tr><td>IMPORTANCE</td><td>• Wheat is a staple food of Pakistan and is a principal source of nutrition for both human beings and animals.
• Phosphorus has key role in improving yield and quality of wheat and other crops as well while our farming community is applying less quantity of phosphorus to the wheat.</td></tr>
<tr><td>OBJECTIVES</td><td>This study is therefore planned to see the effect of phosphorus on nutritional quality and yield of wheat.</td></tr>
<tr><td>RESEARCH WORKERS</td><td>Ms. Maryam Sarfraz, Nisar Ahmad and Khalid Hussain</td></tr>
<tr><td>DURATION</td><td>2017-20</td></tr>
<tr><td>LOCATION</td><td>Biochemistry Section AARI, Faisalabad.</td></tr>
<tr><td>TREATMENTS</td><td>
<table>
<tr><th>Treatments</th><th>Fertilizer kg ha^{-1}</th></tr>
<tr><td>T1</td><td>NK (120-70)</td></tr>
<tr><td>T2</td><td>NK (120-70) + P (60)</td></tr>
<tr><td>T3</td><td>NK (120-70) + P (80)</td></tr>
<tr><td>T4</td><td>NK(120-70) + P (100)</td></tr>
<tr><td>T5</td><td>NK (120-70) + P (120)</td></tr>
</table>
</td></tr>
<tr><td>METHODOLOGY</td><td>Crop will be sown at farm area of Biochemistry Section AARI, Faisalabad by opting necessary agronomic practices during the month of November by following RCBD with three replications. Full dose of phosphorus and potassium will be applied at the time of sowing while nitrogen will be applied in two splits. Data regarding physical parameters will be recorded at the time of harvesting. Grain samples will be collected from each plot, dried, ground and analyzed for dry matter, crude protein, crude fiber, crude fat, ash, Phosphorous, potassium, calcium & NFE.</td></tr>
<tr><td>PREVIOUS YEAR,S RESULTS</td><td>Page-26</td></tr>
</table>

Chemical composition of wheat

Treatments	Fresh Yield (t/ha)	Grain Yield (t ha^{-1})	Straw Yield (t/ha)	Dry Matter (%)
NK (120-70)	8.11 d	3.38 d	4.73 d	90.5
NK (120-70) + P (60)	9.05 c	3.77 c	5.28 c	89.8
NK (120-70) + P (80)	10.2 b	4.26 b	5.96 b	90.1
NK(120-70) + P (100)	10.2 b	4.27 b	5.98 b	90.1
NK (120-70) + P (120)	10.7 a	4.48 a	6.27 a	90.2
CV (%)	**2.66**	**2.73**	**2.73**	**NS**
LSD	**0.48**	**0.21**	**0.29**	

Treatments	Ash (%)	Crude Fat (%)	Crude Protein (%)	Crude Fiber (%)	Phosphorus (%)
NK (120-70)	0.66 c	1.13	9.77 c	0.9 b	0.29 c
NK (120-70) + P (60)	0.85 b	1.22	10.1 b	1.04 a	0.31 bc
NK (120-70) + P (80)	0.87 ab	1.12	10.2 b	0.93 b	0.3 bc
NK(120-70) + P (100)	0.9 ab	1.01	10.3 b	0.96 ab	0.35 ab
NK (120-70) + P (120)	0.94 a	1.19	10.8 a	1.02 a	0.38 a
CV (%)	**4.08**		**1.69**	**4.83**	**7.34**
LSD	**0.06**	**NS**	**0.32**	**0.08**	**0.04**

CONCLUSION:-

Phosphorus application @ 120 kg ha^{-1} along with standard dose of NK produced maximum fresh yield (10.7 t ha^{-1}) grain yield (4.48 t ha^{-1}), straw yield (6.27 t ha^{-1}), ash (0.94 %), crude fat (2.21 %), crude protein (10.8 %) and phosphorus (0.38 %).

TITLE-15	**NUTRITIONAL QUALITY EVALUATION OF VARIETIES/ LINES OF KHARIF FODDERS.**
IMPORTANCE	• Fodder quality is very important for sustainable milk production and animal health as well. • Maize, sorghum and pearl millet are commonly grown kharif fodders of Punjab.
OBJECTIVES	• A study is therefore planned to evaluate the nutritional quality of varieties/ lines of these commonly grown fodders.
RESEARCH WORKERS	Muhammad Zaighum Mushtaq, Nisar Ahmad and Khalid Hussain
DURATION	2017-2020
LOCATION	Biochemistry Section AARI, Faisalabad in collaboration with Fodder Research Institute Sargodha.
TREATMENTS	**Maize fodder varieties / Lines** 1. MMRI yellow selection 2. Pearl selection 3. Fsd-2017 4. MS- 2015 5. MS- 2010 **Sorghum fodder varieties / Lines** 1. SGD 013-I 2. SGD 013-II 3. YS-9800 4. S-89 5. I-4 **Pearl Millet fodder varieties / Lines** 1. Sargodha Bajra 2011 2. G. white 3. BS-2000 4. Composite-I 5. Composite-II
METHODOLOGY	Samples of varieties/lines of maize, sorghum and pearl millet fodder will be collected from Fodder Research Institute Sargodha during September-October. Samples will be dried, ground and analyzed for dry matter, ash, crude fat, crude protein, crude fiber, phosphorus, potassium, calcium& NFE.
PREVIOUS YEAR'S RESULTS	Page-28

Maize

Varieties/ lines	Dry matter %	Ash %	Crude Fat %	Crude fiber %	Crude Protein %	Phosphorous %	Potassium %	NFE %
MMRI yellow	17.41 cd	8.59 ab	3.63 bc	30.02	13.13 a	0.190	1.18 abc	45.23 c
Pearl maize	17.19 de	8.54 ab	4.01 a	29.51	11.38 bcd	0.192	1.20 ab	48.55 abc
Fsd-2017	18.57 a	8.74 ab	3.73 bc	28.31	10.50 d	0.203	1.08 bcde	50.27 a
MS-2015	17.84 bc	8.43 ab	3.66 bc	28.24	12.54 abc	0.199	1.27 a	48.69 abc
MS-2010	17.77 bc	8.88 a	3.68 bc	27.43	12.83 ab	0.209	1.02 e	48.71

Conclusion

FSD-2017 line showed a maximum dry matter (18.57 %) and NFE (50.27%), while crude fiber and crude protein were maximum with MMRI yellow. Ash and phosphorous was found best in line MS-2010 as respectively (8.88%) and (0.209%). In case ofcrude fiber, it was maximum (4.01%) with peal maize and potassium was best with MS-2015.

Sorghum:

Varieties/ lines	Dry matter %	Ash %	Crude Fat %	Crude fiber %	Crude Protein %	Phosphorous %	Potassium %	NFE %
SGD 013-I	19.50 e	9.26 a	3.15 abc	26.75 abcd	9.04 a	0.125 c	0.82 c	51.79 abc
SGD 013-II	20.82 bcd	8.82 ab	2.96 c	27.55 abc	8.75 ab	0.133 bc	0.83 bc	51.93 abc
YS-9800	19.58 de	8.92 ab	3.24 ab	29.55 a	7.58 abc	0.124 c	0.93 abc	50.71 bc
S-89	21.70 ab	9.03 a	3.09 bc	23.04 d	8.46 abc	0.131 c	0.95 ab	56.38 a
I-4	19.86 cde	9.27 a	3.22 ab	29.48 a	8.17abc	0.142 abc	1.02 a	49.86 c

Conclusion

I-4 line showed a maximum ash (9.27 %), crude fat (3.22%), phosphorous (0.142%) and potassium (1.02%). while dry matter and NFE was maximum with S-89 line as respectively

(21.70%) and (56.38%). In case of crude fiber, it was maximum (29.55%) with YS-9800 and crude protein was best with SGD013-I.

Pearl Millet:

Varieties/ lines	Dry matter %	Ash %	Crude Fat %	Crude fiber %	Crude Protein %	Phosphorous %	Potassium %	NFE %
Sargodha Bajra-2011	18.17	10.47 ab	2.24 d	24.30 ab	6.62 abcd	0.187 ab	1.08 abcd	51.57 ab
G.white	18.02	9.43 d	2.15 de	20.57 b	10.79 ab	0.182 ab	1.05 abcd	55.53 a
BS-2000	18.55	10.46 ab	2.47 c	23.57 ab	9.33 bcd	0.185 ab	1 d	52.98 a
Composite-I	18.22	10.01 bcd	2.68 b	24.77 ab	9.04 cd	0.193 ab	1.12 abc	52.47 ab
Composite-II	18.53	9.86 bcd	2.75 b	23.40 ab	8.75 d	0.199 ab	1.07 abcd	54.48 a

Conclusion

Composite-I line showed a maximum crude fiber (24.77 %) and potassium (1.12%). While crude protein and NFE was maximum with G.white line as respectively (10.79%) and (55.53%). Composite-II variety produced maximum result for crude fat (2.75%) and phosphorous (0.199%). In case of dry matter, it was maximum (18.55%) with BS-2000 and ash was best (10.47%) with Sargodha Bajra-2011.

TITLE-16	EFFECT OF MICROBIAL INOCULATION ON NUTRITIONAL QUALITY OF MASH GENOTYPES
IMPORTANCE	• Mash bean is an important pulse crop used in Pakistan. It has great value as food. • In addition to improve the soil fertility, it is an economic source of protein for human consumption. • Inoculation with beneficial microbes plays a key role in nodulation and yield.
OBJECTIVES	• Present study is therefore designed to evaluate the role of microbial inoculation in nutritional value of different genotypes of mash.
RESEARCH WORKERS	Waqar Ahmad, Nisar Ahmad and Khalid Hussain
DURATION	2017-2020
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabadin collaboration with Pulses Research Institute, Faisalabad.
TREATMENTS	**Varieties** 1. Mash 97 2. Arooj 2011 **Promising Lines** 1. 15M002 2. 15M004 3. 15M007 4. 15M008
METHODOLOGY	Crop will be sown at field area of Pulses Research Institute, Faisalabad by opting necessary agronomic practices following RCBD with three replications. Recommended dose of NP (25-60 kg ha^{-1}) will be applied at the time of sowing. One set of treatment will be inoculated with microbial strains while the other remains un-inoculated and treated as control. Data regarding yield and nodulation will be recorded. Samples will be dried, ground and analyzed for dry matter, crude protein, crude fiber, crude fat, ash and phosphorus.
PREVIOUS YEAR'S RESULTS	Page-31

Nutritional quality parameters of different varieties/lines of mash bean

Varieties/ Line	Crude protein (%)		Crude fat (%)		Crude fiber (%)		Ash (%)		NFE	
	Inoculated	Un-inoculated	Inoculated	Un-inoculated	Inoculated	Un-inoculated	Inoculated	Un-inoculated	Inoculated	Un-inoculated
15M001	24.03a b	22.10 d-f	1.23a	1.11b-d	3.75a b	3.52b c	3.89a	3.40c d	67.11f-h	69.86 bc
15M002	23.65b c	21.85 ef	1.21a b	1.09c d	3.56b c	3.13d	3.48b-d	3.30d	68.11 d-f	70.62 ab
15M004	25.07a	22.51 c-e	1.19a-c	1.15a-d	3.58b c	3.22d	3.75a-c	3.26d	66.40 h	69.87 a-c
15M008	24.30a b	23.07 b-e	1.19a-c	1.06d	4.01a	3.41c d	3.82a b	3.43c d	66.68 gh	69.03 c-e
Mash97	23.19b-e	22.64 c-e	1.21a b	1.11b-d	3.72b	3.34c d	3.55a-d	3.55a-d	68.32 d-f	69.36 b-d
Arooj97	23.41b-d	20.98f	1.20a b	1.14a-d	3.79a b	3.39c d	3.80a b	3.28d	67.80 e-g	71.21 a
CV	3.45		5.29		4.75		6.09		1.16	
LSD	1.34		0.10		0.28		0.36		1.34	

Conclusion

Line No. 15M001 when inoculated showed maximum value for crude fat (1.23%) and ash (3.89%). Maximum crude protein (25.07%) was found in line no. 15M004 inoculated. Crude fiber (4.01%) was found best in line 15M008 when inoculated and Maximum NFE (71.21) was observed in Arooj-97 without inoculation.

TITLE-17	**DIFFERENTIAL RESPONSE OF MUNGBEAN GENOTYPES TOWARDS NUTRITIONAL QUALITY DUE TO MICROBIAL INOCULATION**
IMPORTANCE	• Pulses have a special role in food security on account of their ability to reduce protein malnutrition. • Mungbean is an important protein source for people. It contains about twice as much protein as cereals. • Inoculation with beneficial rhizobacteria plays a key role in nodulation and yield of legumes.
OBJECTIVES	• Keeping in view, the present study is design to evaluate the role of microbial inoculation in nutritional quality improvement of different varieties of mungbean.
RESEARCH WORKERS	Waqar Ahmad, Nisar Ahmad and Khalid Hussain
DURATION	2016-19
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad
TREATMENTS	**Varieties** 1. Chakwal Mung-2006 2. AZRIMung-06 3. NM– 2006 4. NM-2011 **Lines** 1. 16001 2. 16002 3. 16003 4. 16004 5. 15003 6. 15005
METHODOLOGY	Crop will be sown by opting necessary agronomic practices following RCBD with four replications. Recommended doses (25-60 N, P kg/ha) of fertilizer will be applied at sowing. One set of treatment will be inoculated with microbial strains while the other remains un-inoculated and treated as control. Data regarding yield and nodulation will be recorded. Samples will be dried, ground and analyzed for dry matter, crude protein, crude fiber, crude fat, ash, hard grain and phosphorus.
PREVIOUS YEAR'S RESULTS	Page-33

Nutritional quality parameters of different varieties/lines of mung bean

Varieties/Line	Crude protein (%)		Crude fat (%)		Crude fiber (%)		Ash (%)		NFE	
	Inoculated	Un-inoculated	Inoculated	Un-inoculated	Inoculated	Un-inoculated	Inoculated	Un-inoculated	Inoculated	Un-inoculated
15003	23.91bc	23.42 c	1.32ab	1.12c	4.93a	3.92de	3.96a-c	3.58ef	65.87d-g	67.96a
14005	25.35a	23.57 c	1.35ab	1.19c	3.91de	3.77e	3.87a-d	3.70c-f	65.51fg	67.77ab
15005	24.82ab	23.91 bc	1.19c	1.19c	4.87ab	4.22cd	3.88a-d	3.44f	65.24g	67.24a-c
08009	23.89bc	23.77 c	1.41a	1.19c	5.15a	4.51bc	4.01ab	3.69d-f	65.55e-g	66.84b-d
AZRI 2006	24.01bc	24.01 bc	1.18c	1.14c	4.47bc	4.13c-e	4.04a	3.75b-f	66.31c-f	66.98a-c
NM 16	24.21bc	23.60 c	1.22c	1.14c	4.12c-e	3.84de	3.90a-d	3.68d-f	66.54c-e	67.75ab
CV	2.36		6.46		5.62		4.12		0.89	
LSD	0.96		0.13		0.41		0.26		0.99	

Conclusion

It was observed that maximum crude protein (25.35 %) and crude fat (1.35 %) was observed in line No. 14005 with inoculation. Maximum crude fiber (5.15 %) was observed in line no. 08009 inoculated, while maximum ash (4.04 %) was observed in AZRI 2006 with inoculation.

TITLE-18	**EFFECT OF EXOGENOUS APPLICATION OF GIBBERELLIC ACID ON NUTRITIONAL STATUS OF WHEAT UNDER DROUGHT STRESS**
IMPORTANCE	• Wheat is grown on 1.7 million hectares under dry land farming in Punjab with a high probability of drought spells during the vegetative and reproductive growth. • Drought affects crop growth and nutritional quality by changing metabolic and physiological pathways. • Exogenous application of gibberellic acid improves the water stress tolerance in wheat plants by maintaining different physiological parameters.
OBJECTIVES	• Present study is designed to check the effect of gibberellic acid on nutritional status of wheat under drought stress.
RESEARCH WORKERS	Waqar Ahmad, Nisar Ahmad and Khalid Hussain
DURATION	2016-19
LOCATION	Biochemistry Section, PHRC, AARI, Faisalabad
TREATMENT	**Gibberellic Acid Application Rate** 1. Control 2. Foliar application at $10^{-4}M$ after 7 days of sowing (Emergence) 3. Foliar application at $10^{-4}M$ after 21 days of sowing days (Tillering) 4. Foliar application at $10^{-4}M$ after 28 days of sowing (Jointing) **Moisture Levels** 1. 40% of the field capacity 2. 60% of the field capacity 3. 80% of the field capacity 4. Field capacity
METHODOLOGY	A pot study will be conducted at Biochemistry Section, PHRC, AARI Faisalabad. Recommended rate of NPK will be applied. Gibberellic acid at the rate of $10^{-4}M$ is applied to the wheat crop at different developmental stages. Crop will be harvested at maturity. Grain yield will be recorded at time of harvesting. Samples will be collected from each treatment, dried, ground and analyzed for dry matter, crude protein, crude fat, crude fiber, ash and NFE.
PREVIOUS YEARS' RESULTS	Page-35

Analysis Results

Treatments	Grain yield (g pot^{-1})	Dry Matter (%)	Crude Protein (%)	Crude Fat (%)
40 % Field capacity + 0 *M* Gibberellic Acid	8.32e	92.18a	10.76c	1.17c
60 % Field Capacity + 0 *M* Gibberellic Acid	11.74c	91.76ab	11.20bc	1.76ab
80 % Field Capacity + 0 *M* Gibberellic Acid	12.82c	90.25c-e	11.38bc	1.78ab
100 % Field Capacity + 0 *M* Gibberellic Acid	14.45b	89.26ef	11.29bc	2.04a
40 % Field capacity + 10^{-4}*M* Gibberellic Acid	9.89d	91.50a-c	11.55b	1.48bc
60 % Field Capacity + 10^{-4}*M* Gibberellic Acid	11.96c	90.78b-d	12.78a	1.85ab
80 % Field Capacity + 10^{-4}*M* Gibberellic Acid	14.39b	90.12de	12.43a	1.92a
100 % Field Capacity + 10^{-4}*M* Gibberellic Acid	16.72a	88.56f	12.95a	2.07a
CV (%)	**5.48**	**0.82**	**3.67**	**13.25**
LSD	**1.18**	**1.29**	**0.74**	**0.40**

Treatments	Crude Fiber (%)	Ash (%)	NFE (%)
40 % Field capacity + 0 *M* Gibberellic Acid	1.38a	1.23c	85.45a
60 % Field Capacity+0 *M* Gibberellic Acid	1.30ab	1.56b	84.18b
80 % Field Capacity+0 *M* Gibberellic Acid	1.33a	1.66ab	83.85b
100 % Field Capacity+0 *M* Gibberellic Acid	1.23ab	1.70ab	83.74bc
40 % Field capacity+10^{-4}*M* Gibberellic Acid	1.29ab	1.59b	84.08b
60 % Field Capacity+10^{-4}*M* Gibberellic Acid	1.15ab	1.78ab	82.43d
80 % Field Capacity+10^{-4}*M* Gibberellic Acid	1.08ab	1.82ab	82.76cd
100 % Field Capacity+10^{-4}*M* Gibberellic Acid	0.95b	1.91a	82.11d
CV (%)	**16.78**	**9.53**	**0.70**
LSD	**0.39**	**0.27**	**1.01**

Conclusion: Maximum grain yield (16.72 g pot^{-1}), crude protein (12.95%), crude fat (2.07 %) was observed at 100% field capacity with gibberellic acid application while maximum dry matter (92.18 %) and crude fiber (1.38 %) was observed at 40 % of the field capacity without gibberellic acid application and maximum NFE (85.45 %) was observed at 40 % field capacity without gibberellic acid application.

TITLE-19	**ADVISORY SERVICE**
OBJECTIVES	To test the quality of samples (proximate analysis) received from crop specialists and institutions
RESEARCH WORKERS	Maryam Sarfraz, Muhammad Zaighum Mushtaq, Dr. Naseem Akhter, Waqar Ahmad , Sobia Noor, Nisar Ahmad and Khalid Hussain.
DURATION	Continuous
LOCATION	Biochemistry Section AARI, Faisalabad
TREATMENTS	Samples received from different Institutions
METHODOLOGY	Samples will be analyzed for quality parameters i.e. crude protein, crude fiber, crude fat, dry matter, ash, TSS. pH, sugars etc.
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	ADVISORY SERVICE

S. No.	Source	Name of sample	No. of samples	Analysis Detail
1	Director Pulses Research institute Faisalabad	Gram	46	Dry matter, ash, crude protein, crude fat.
		Mung Bean	78	
		Chick peas	02	
		Peas	04	
2.	Director PHRC, Faisalabad	Biscuits	10	Crude protein, crude fiber.
		Wheat grain	04	Crud fat, crude protein, crude fiber
		peas	30	starch
		Wheat yarn flour	05	Crud fat, crude protein, crude fiber
		Turmeric drink	05	Total Phenols
		Tomato	30	Lycopene, Total sugar, ascorbic acid. Beta carotene.
		Quinoa	03	Proximate analysis
3	Director Horticulture Research Institute Faisalabad	Guava	28	TSS, Sugar, Antioxidant, Vit-C.
		Dates	10	pH, TSS, ash, Moisture, Total phenols.
4	Director Fodder Research Institute, Sargodha.	Lucern, berseem, oat, rye grass	85	Proximate analysis
5	Director Agronomic Research Institute, Faisalabad	Gram	20	Crude fat, crude protein
		Grain	07	Proximate analysis
		Mung bean	02	Proximate analysis
		Maize grain	08	Proximate analysis
6	Director Oil seed, Research Institute. Faisalabad	Linseed	02	Crude protein
9	Soil Bacteriologist, Faisalabad	Tomato	16	TSS. Acidity, Vit-C
10	Plant Physiologist, Faisalabad	Maize	10	Crude Fat, Crude Protein
11	Agronomist, Forage production, Faisalabad	Milk	24	pH, Specific gravity, Protein, Fat, SNF.
		Fodders	21	Ash, Crude Fat, Crude Protein, crude fiber.
Total Number of Samples			**450**	

Concluding Experiments

Sr. #.	Name of Experiments	Treatments	Results
1.	Assessment of antioxidant potential of different fruits	1- Banana 2- Mulberry 3-Straw berry 4-Loquat 5-Melon 6-Guava 7-Melon(China) 8-Grapes 9-Apricot 10-Mango 11-Falsa	Among all the fruits higher percentage of total phenols was observed in grapes (1266.4 µg GAE /mL respectively) while Vit. C (19.74 mg/100 ml), TSS (13.9%) and antioxidants (91.2% DPPH Scavenging activities) were higher in Mango. Therefore mango is recommended as more nutritious fruit than all the given fruits.
2.	Assessment of nutritional quality of vegetables grown in different tehsils of faisalabad district.	**Tehsil Name Summer Vegetables Winter Vegetables** **Jaranwala** (Brinjal, bitter gourd) (carrot, radish) **Samundri** (Brinjal,bitter gourd) (carrot, radish) **(Faisalabad)** (Brinjal,bitter gourd) (carrot, radish)	It was concluded that moisture percentage, ash, fats, fiber and protein were found higher in the vegetables, collected from Farmers field of Tehsil Jaranwala while carbohydrates were found higher in vegetables, collected from Tehsil Samundary.

3.	Effect of irrigation frequencies and its time of application on hcn level in sorghum	T1= One Irrigation (at 20 days after sowing) T2= One Irrigation (at 30 days after sowing) T3= One Irrigation (at 40 days after sowing) T4=Two Irrigation (at 20 days after sowing + at 30 days after sowing) T5= Two Irrigation (at 20 days after sowing + at 40 days after sowing) T6= Two Irrigation (at 30 days after sowing + at 40 days after sowing) T7=Three Irrigation (at 20 days after sowing+ at 30 days after sowing+ at 40 days after sowing) All the agronomic practices were kept uniform. Data regarding HCN level was determined in fresh fodder, dry matter and crude protein was recorded after sample drying.	Sorghum fodder was analyzed for HCN and Crude protein and it is concluded that protein was significantly higher in T4, T5, T6 and T7 while HCN was found higher in treatments where irrigation was applied 20 and 30 days after sowing**.**
4	Quality comparison of hybrid vs. synthetic varieties of maize, rice and canola	**1- Maize.** **Synthetic (**Malka 2016) **Hybrid (**FH-793, 2.FH-922, 3.FH-929, 4.FH-932, 5. FH- 949, 6. FH-950, 7. FH-988, 8. FH-1046, 9. FH-1205, 10.FH-1304, 11.DK-6724, 12. NK-8441). **2-Rice .** **Synthetic (**Basmati 515, Chanab basmati,	Samples of maize, rice and canola were collecte Maize Research Station, Faisalabad, Rice R Institute, Kala Shah Kako and Oil Seed R Institute, Faisalabad. Crude protein ranged from 8.95% (maximum 8.95%) in maize hybr 1266.Ricehybrid Maharani 1 was found better higher crude protein (7.85%), crude fat (1.31

		Punjab basmati, Kissan basmati, Super basmati) **Hybrid (**Maharani-1Maharani-2). **3**.**Canola** **Synthetic (**Punjab Sarsoon, Faisal Canola) **Hybrid**(Hayola 401, Faisalabad Hybrid)	crude fiber (1.09%).Canola hybrid Hyola 401 wa better due to high moisture content (3.80%) and c (36.6%). Ash content (5.79%) and crude protein (were found better in Faisalabad Hybrid. Overall performed better than synthetic varieties in rice, and maize.
5	Effect of cutting interval on crude protein, fiber content and dry matter yield of alfalfa	**Stage of Cuttings** T1:Continuous cuttings after every 20 days T2:Continuous cuttings after every 30 days T3:Continuous cuttings after every 40 days T4:Continuous cuttings after every 50 days	Alfalfa is a perennial fodder. This study is planned to investigate the effect of stage of cutting interval on its quality.It is concluded that crude protein (16.6%), dry matter (24.7%) and crude fiber (35.2%) were found better in alfalfa cut after 50 days of sowing.
6	Quality evaluation of ruminants' milk and volatile fatty acids contents of ghee with reference to seasonal variation	T1- Buffalo T2-Cow	It was concluded that buffalo milk has maximu protein (5.04%) in the month of October and No maximum fat (6.8%) in the month of Janua specific gravity (1.031) in the month of March. In cow milk, it has maximum pH (6.82), crude (3.68) in the month of December and fat (4.3% month of February.
7	Effect of different substrates on nutritional composition and protein yield of selected varieties of mushroom	**Varieties** 1- Oyster Mushroom (*Pleaurotus* spp.) 2- European or Button Mushroom (*Agaricusbisporus*)	Wheat & rice straw showed maximum protein (2 and mineral matter (8.90%) in oyster mushroom in case of Button mushroom maximum crude fat (and mineral matter (8.94%) were observed in co

		Substrates 1- Wheat straw 2- Rice straw 3- Cotton waste 4- Wheat straw + Rice straw 5- Rice straw + Cotton waste 6- Wheat straw + Cotton waste 7- Wheat straw + Rice straw + cotton waste	treatment of wheat, rice straw and cotton waste.