1. HORTICULTURE SECTION

<table>
<tr><td>1.1 Title</td><td colspan="3">Use of interstocks technique in mango to evaluate its impact on plant dwarfness and fruit maturity in mango Cv. Sindhri</td></tr>
<tr><td>Objective</td><td colspan="3">To induce dwarfness in vigorously growing mango cultivar Sindhri and to study its impact on time of fruit maturity</td></tr>
<tr><td>Research Worker</td><td colspan="3">Ghulam Mustafa, Asif ur Rehman Hafiz and Sidra Kiran</td></tr>
<tr><td>Project Duration</td><td colspan="3">2012-2022</td></tr>
<tr><td>Location</td><td colspan="3">Mango Research Institute, Multan</td></tr>
<tr><td>Treatment</td><td>Treatment</td><td colspan="2">Description</td></tr>
<tr><td></td><td>T1</td><td colspan="2">Sensation as Interstock</td></tr>
<tr><td></td><td>T2</td><td colspan="2">Tota Pari as Interstock</td></tr>
<tr><td></td><td>T3</td><td colspan="2">Neelum as Interstock</td></tr>
<tr><td></td><td>T4</td><td colspan="2">Sindhri as Interstock (Control)</td></tr>
<tr><td>Lay Out</td><td colspan="2">Design</td><td>RCBD</td></tr>
<tr><td></td><td colspan="2">Treatments</td><td>04</td></tr>
<tr><td></td><td colspan="2">Replications</td><td>05</td></tr>
<tr><td></td><td colspan="2">No. of Plants/replication</td><td>01</td></tr>
<tr><td></td><td colspan="2">Total No. of plants</td><td>20</td></tr>
<tr><td>Plan of Work</td><td colspan="3">13-1 is used as rootstock and the stones of this rootstock will be sown in July-August 2013. The seedlings will be transplanted in the nursery and Sensation, Neelum and Tota Pari will be grafted in 2014 on the rootstocks. The Sindhri will be grafted on the interstocks keeping the length of interstock as 30cm during 2015. The said plants were transferred to bigger pots for further growth in October, 2016. These plants will be transplanted in the field for required studies in October, 2017.</td></tr>
<tr><td>Parameters</td><td colspan="3">Growth Data</td></tr>
<tr><td></td><td>Sr. No.</td><td colspan="2">Parameter</td></tr>
<tr><td></td><td>1</td><td colspan="2">Flush length (cm)</td></tr>
<tr><td></td><td>2</td><td colspan="2">No. of leaves/ flush</td></tr>
<tr><td></td><td>3</td><td colspan="2">No. of vegetative flushes/year</td></tr>
<tr><td></td><td>4</td><td colspan="2">Plant height (m)</td></tr>
<tr><td></td><td>5</td><td colspan="2">Plant spread (m)</td></tr>
<tr><td></td><td>6</td><td colspan="2">Scion/Stock /inter stock girth (cm) (To study scion/inter stock/stock compatibility)</td></tr>
<tr><td></td><td colspan="3">Fruit Data</td></tr>
<tr><td></td><td>1</td><td colspan="2">Time of fruit maturity (Days)</td></tr>
<tr><td></td><td>2</td><td colspan="2">Fruit yield /plant (Kg)</td></tr>
<tr><td></td><td>3</td><td colspan="2">Av. fruit weight (g)</td></tr>
<tr><td></td><td>4</td><td colspan="2">Pulp (%)</td></tr>
<tr><td></td><td>5</td><td colspan="2">Stone weight (g)</td></tr>
<tr><td></td><td>6</td><td colspan="2">Stone size (cm^2)</td></tr>
<tr><td></td><td>7</td><td colspan="2">TSS %</td></tr>
<tr><td></td><td>8</td><td colspan="2">Acidity %</td></tr>
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Previous Year Results	Treatment	No. of Plants	Plant height (cm)	No. of flushes/plant	Flush length (cm)	No. of leaves/flush
13-1-Sen-Sindhri	T1	08	76.3	5	15	09
13-1-TP-Sindhri	T2	08	55.0	4	20	11
13-1-Ne-Sindhri	T3	08	66.5	5	17	10
13-1-Sin-Sindhri	T4	08	89.3	6	16	12

1.2 Title	**Development of new mango varieties through hybridization**		
Objective:	To develop new mango varieties having better yield and quality		
Research Worker	Ghulam Mustafa, Hafiz Asif-ur-Rehman, Javed Iqbal and Atif Iqbal		
Project Duration	2012 to onwards		
Location	Mango Research Institute, Multan		
Treatment	**Sr. No.**	**Crosses**	**Objective**
	T1	Sufaid Chaunsa x Sindhri	To evolve mid-season mango variety with superior traits
	T2	Sindhri x Sufaid Chaunsa	
	T3	Sindhri x SB Chaunsa	To enhance fruit quality, shelf life of Chaunsa Sammar Bahishat
	T4	SB Chaunsa x Sindhri	
	T5	SB Chasunsa x Sensation	To develop dwarf stature plant with superior traits
	T6	Sensation x SB Chaunsa	
plan of work	Pollen Sacs of the desired varieties will be selected and collected in the Petri dishes one day before making pollination. The collected pollens will be incubated at 25°C for 03 hours. The dehisced pollens from the pollen sacs will be collected with fine camel hair brush or fine hair brush into 5%, 50ml solution of α-D glucose solution. That solution then will be stirred at 10°C for 02-03 minutes. Next day early in the morning (6-8 am) selection of desired variety's panicle (having tightly closed flower buds and which are just near to open) by visual observation, will be made. All open flowers will be removed and emasculation will be practiced. Then with the help of a dropper, a drop of α-D glucose solution having pollens will be placed on the emasculated flower. At least 35-40 crosses will be made on the same panicle by repeating the same protocols of breeding. In the end tags showing the date of cross, name of parent plant and number of crosses made, will be hanged on the pollinated panicles. Next day more crosses will be made on the same panicles for non-pollinated/ near to open flowers. The pollinated flowers color will turn greenish which will be sign of successful crossing. Fortnightly data will be recorded for number of fruit sets, fruit drop and finally the number of fruit harvested at maturity.		
Parameters	**Sr. No.**	**Description**	
	1	Total No. of crosses made	

	2	No. of fruit setting
	3	Fruit available on each terminal monthly data (April-Aug.)
	4	No. of fruit harvested
	5	No. of stone germinated
	6	Germination %

Previous Year Results (2016)

#	Crosses	Crosses made	No. of Fruit setting	Fruit Setting (%)	Pea Stage	Marble Stage	Fruit Harvested	No. of Stones Sown	No. of Stones Germinated
1	Sufaid Chaunsa × Sindhri	300	35	11.6	08	02			
2	Sindhri × Sufaid Chaunsa	300	23	7.6	04	0			
3	Sindhri x SB Chaunsa	300	18	6.0	08	06	02	02	02
4	SB Chaunsa x Sindhri	300	12	4.0	03				
5	SB Chaunsa x Sensation	300	05	1.6	03	02	01	01	01
6	Sensation x SB Chaunsa	300	25	8.3	12	03			
	TOTAL	**1800**	**118**	**6.5**	**38**	**13**	**03**	**03**	**03**

The stones of the hybrid fruits were sown in the pots for germination purpose. Two hybrid plants in T3 and one in T5 were achieved

(Outcome of hybridization program of 2014)

#	Hybrids	Plant Height (cm)	No. of flush/Plant	No. of leaves/flush	Leaf length (cm)	Flush Length (cm)
1	Sindhri x Sufaid Chaunsa	131	16	07	22	14
2	SB Chaunsa x Sindhri	107	14	08	27	14
3	Sensation x SB Chaunsa	172	12	09	19	16

The hybrids plants were kept under lath house conditions under intensive care. These are flourishing well and the scion of hybrid plants will be grafted on big tree for the maturity as a short cut approach for further evaluation.

1.3 Title	**Response of various mango cultivars towards stone grafting**		
Objective	To explore the possibility of mango nursery plants in a short duration period.		
Research Worker	Ghulam Mustafa, Asif ur Rehman Hafiz, Atif Iqbal and Sidra Kiran		
Project Duration	2015-2017		
Location	Mango Research Institute, Multan		
Treatment	**Treatment**	**Factor-1**	**Factor-2**
		Seedling Varieties	**Seedling Age**
	T1	Sindhri	10
	T2	SB Chaunsa	15
	T3	Sufaid Chaunsa	20
LAY OUT	Design	RCBD	
	Treatments-Factor-1	03	

	Treatments-Factor-2	03
	Replications	5
	No. of Plants/replication	5
	Total No. of plants	225
Plan of work	The stones of mango will be grown in the pot media. Scion wood with uniform maturity, containing 4 and 6 well developed vegetative buds and free from any infestation of disease and pests will be selected. This type of scion materials will be collected from the healthy and mature trees of standard commercial variety i.e. Sindhri. Stone grafting will be performed by employing epicotyls method inside the poly house. In this method, the rootstocks will be selected with proper age and thickness of stem for stone grafting. And grafting procedure will be repeated after every four days interval from germination of the stones.	
Parameter	**Sr. No.**	**Parameter**
	1	Diameter of root stock (mm)
	2	Diameter of scion (mm)
	3	Success of grafting (%)
	4	No. of vegetative flushes/year
	5	Length of graft (cm)
	6	No. of leaves/Flush

Previous Year Results

Treatments	Seedling age (Days)	Diameter of Rootstock (mm)	Diameter of Scion (mm)	Success (%)	No. of flush/plant	Flush length (cm)	No. of leaves/flush
Sindhri	10	6.51	5.41	60	01	05	05
	15	8.14	6.84	64	01	06	06
	20	9.42	7.16	56	01	05	05
SB Chaunsa	10	7.24	6.46	68	01	06	06
	15	8.48	7.16	72	01	08	07
	20	8.86	70.48	64	01	06	07
Sufaid Chaunsa	10	4.10	3.73	64	01	05	05
	15	5.42	4.34	68	01	07	06
	20	6.78	5.56	64	01	04	04

1.4 Title	**Performance of mango cultivar Sammar Bahisht Chaunsa on various polyembryonic mango rootstocks**		
Objective:	To select the best rootstock for mango cultivar Sammar Bahisht Chaunsa to control the mango sudden death disease and to ensure better yield and fruit quality		
Research Worker	Hafiz Asif-ur-Rehman, Atif Iqbal and Muhammad Tariq Malik		
Project Duration	2013-2020		
Location	Mango Research Institute, Multan		
Treatment	**Treatment**	**Rootstock**	**Description**
	T1	Carabao Super Manila	Polyembryonic rootstock

	T2	Kensington Pride	Polyembryonic rootstock
	T3	R2E2	Polyembryonic rootstock

Lay out	Design	RCBD
	Treatments	3
	Replications	5
	No. of Plants/Replication	2
	Total Plants	30
Plan of Work	Mango fruit of rootstocks for stone purpose will be collected from Mango Research Station, Shujabad and stones of the said varieties (Carabao, Kensington Pride and R_2E_2) for rootstocks will be sown during July-August 2014 and scion varieties (SB Chaunsa will be grafted on these rootstocks in July-August 2015. At least 05 plants will be prepared in the nursery for field trial under each treatment.	
Parameters	**Horticultural Evaluation**	**Screening against MQWD**
	1. Plant Height (cm)	**Extent of symptom expression on LEAVES**
	2. Plant Spread (cm)	Necrosis, Withering, Yellowing, Drying
	3. Scion/Stock girth (cm)	**Extent of symptom expression on STEM**
	4. No. of flushes/plant	Gummosis, Cankers, Lesion, Drying
	5. Flush Length (cm)	
	6. No. of leaves/Flush	

Previous Year Results

Treatments	Rootstock	Plant Height (cm)	No. of flush/Plant	Flush Length (cm)	No. of leaves/Flush
T1	Carabao	65	07	05	05
T2	Kensington Pride	73	08	06	07
T3	R2E2	48	06	05	06

These plants were kept under lath house in intensive care, keeping in view their small size. These plants will be shifted into field conditions for horticultural evaluation and bigger pot for screening studies.

1.5 Title	**Survey for the selection of new promising mango varieties**
OBJECTIVE:	To select the new mango varieties of exportable quality having better shelf life
Research Worker	Dr. Hameed Ullah, Ghulam Mustafa and Asif ur Rehman
Project Duration	2012- Onward (Long Term)
Location	Punjab
Treatment	Intensive survey regarding the exploration of elite mango selections of whole mango region to enrich existing gene pool.
Plan of work	Promising varieties of mango having good quality features in Punjab will be observed. Good featured varieties will be selected and studied for 2 years for different traits. Then bud wood of convincing varieties will be collected and will be grafted on mango plants at Mango Research Institute, Multan for its further study and exploitation.

New Selections	**Sr. No.**	**Selection Identified**	**Fruit weight (g)**	**Peel weight (g)**	**Stone weight (g)**	**Pulp weight/Fruit (g)**	**TSS (%)**
	1	Zeeshan	240	35	40	165	28.0
	2	Paradesi	415	35	42	338	22.4
	3	Sajjan	320	55	73	192	24.5
	4	MRI-1	450	18	35	397	18.8
	Bud wood of newly identified mango selections were grafted in sectional mango nursery and kept under lath house condition for their further growth.						

1.6 title	**Effect of planting geometry on yield and quality of Sindhri**				
objective	To evaluate the appropriate density for high yield and better fruit quality of mango cultivar Sindhri under climatic condition of Multan				
Research Worker	Ghulam Mustafa, Asif ur Rehman Hafiz, Dr. Hameed Ullah and Abdul Ghaffar Grewal				
Project Duration	2015-2025				
Location	Grower Field and Mango Research Institute, Multan				
Treatment	**Treatment**	**Planting Geometry**	**Plant Density (Plants/acre)**	**Tree Dimension (feet)**	
				Tree Height	**Canopy Diameter**
	T1	25' X 20'	87	12.5	16.6
	T2	30' X 25'	58	15.6	20.8
	T3	35' X 30'	42	18.7	25.0
	T4	40' X 40'	27	25	33.3
	T5	27' X 22'	73	13.7	18.3
Lay out	Design	RCBD			
	Treatment	5			
	Experimental Area	½ acre			
	Total plantation	2 acre			
Plan of work	**Grower Field**		**Mango Research Institute, Multan**		
	The feasibility of the above mentioned plating geometry will be searched out at grower field level. The study will be conducted at grower field level simultaneously.		These plants will be shifted in August-September at mentioned distances. Plant growth data will be recorded accordingly. At plant maturity, the tree height and canopy diameter will be managed according to the formula		
Formula for tree structure	The tree height will be calculated by multiplying plant to plant distance into a factor of 5/8 while canopy diameter will be calculated by multiplying tree height into a factor of 4/3.				
Parameter		**Parameter**			
	Sr. No.	**Growth Parameters**	**Yield attributes**		
		Plant height (cm)	Flowering Terminal (%)		
		Canopy Volume (m^3)	Fruiting Terminal (%)		
		Canopy Diameter	Fruit weight (g)		
		Quality Parameters	Yield/Tree (kg)		

		TSS (%)		Total number of fruits/tree	
		Acidity (%)		A-B-C Grade Fruits (%)	
		Shelf Life (ambient conditions)			
Previous year Results	**Treatment**	**Plant height (cm)**	**No. of Flush/Plant**	**Flush Length (cm)**	**Leaves/Flush (cm)**
	25' x 20'	86.6	09	07	9.0
	30' x 25'	82.0	07	7.2	7.0
	35' x 30'	83.2	08	7.0	8.0
	40' x 40'	83.4	09	7.1	8.0

1.7 Title	**Some advances to combat the alternate bearing disorder in mango Cv. SB Chaunsa**			
Objective	To rectify irregular bearing habit in mango Cv. SB Chaunsa through management practices			
Research Worker	Hameedullah, Asif ur Rehman, Ghulam Mustafa			
Project Duration	2016-2020			
Location	Mango Research Institute, Multan			
Treatment	**Treatment**	**Description**		
	To	Control		
	T1	Split application of N, P, K @ 500g a.i. each) in February, April, July and September		
	T2	Three spray of KNO_3 @ 1% just after harvest with 15 days interval after on-year		
	T3	Harvesting of fruits at start of TAPKA		
	T4	Stop irrigation in October for on-year plants		
Lay Out	Design	RCBD		
	Treatment	05		
	Replication	03		
	Total No. of Plants	15		
Plan of Work	Uniform plants of Cv. SB Chaunsa will be selected and tagged. All the standard practices will be applied except in case of treatments. Data will be recorded and interpreted to reveal the results.			
Parameter	1. Flowering Terminal (%) 2. Fruiting Terminal (%) 3. Yield (kg/plant)			
Results	**Treatment**	**Flowering Terminal %**	**Fruiting Terminal%**	**Yield/Plant (kg)**
	To	72	55	105
	T1	65	60	115
	T2	73	65	135
	T3	71	57	120

	T4	68	68	138

1.8 title	**Effect of different chemicals for the degradation of paclobutrazol in mango tree**		
Objective	To determine the most effective remedy for the rehabilitation of mango Cv. SB Chaunsa tree foliage growth as arrested by non-judicious use of paclobutrazol		
Research Worker	Javed Iqbal, Asif ur Rehman, Ghulam Mustafa and Atif Iqbal		
Project Duration	2017-20		
Location	Grower Field		
Treatment	**Treatment**	**Description**	
	T1	Control (Normal Practice)	
	T2	GA_3 foliar spray @ 150ppm	
	T3	KNO_3 @ 2% foliar spray	
	T4	Soil application of $CuSO_4$ @ 500g in March and August	
	T5	T1 + T2	
	T6	T2 + T3	
	T7	T1 + T2 + T3	
Lay Out	Design	RCBD	
	Treatment	07	
	Replication	03	
	No. Plants/Replication	01	
	Total No. of Plants	21	
Criteria	The mango plants those growth was arrested by the non-judicious use of paclobutrazol will be judged at various tree phenological stages as: Extent of symptom expression of the paclobutrazol applied trees. **FLOWERING PHASE** Flowering Terminal (%) Fruiting Terminal (%) Panicle length (cm) **FRUIT DEVELOPMENT PHASE** Size of fruit Number of fruits/tree **VEGETATIVE PHASE** Vegetative flushes (%) Leaf length (cm) Internodal distance (cm) **GENERAL APPEARANCE** Health of the tree Insect attack Disease attack **HISTORY OF THE ORCHARD** The grower claimed that mango trees were regularly applied paclobutrazol by the tractor since (04) year. Resultantly, mango trees become stunted and less productive.		

Plan of Work	Foliar application of GA_3 and KNO_3 will be applied in the month of April, June and August.
Parameter	1. Vegetative Flushes (%) 2. Flowering Terminal (%) 3. Fruiting Terminal (%) 4. Yield/Plant (kg)
Results	New Experiment

1.9 title	**Effect of different chemical to protect mango seedlings from frost and cold weather injuries**		
Objective	To determine the effective treatment against the prevailing frost/cold weather injuries for mango seedlings		
Research Worker	Javed Iqbal, Atif Iqbal, Sidra Kiran		
Project Duration	2016-2020		
Location	Mango Research Institute, Multan		
Treatment	**Treatment**	**Description**	
	T1	Control	
	T2	H_2O_2 50ppm	
	T3	Ascorbic acid 100ppm	
	T4	Salicylic acid 0.5 mM	
		COMMERCIAL PRODUCTS	
	T5	WetCit 400ml/100l water (02spray at 12 days interval)	
	T6	Megafal @ 250ml/100l water (Repeated after every 07 days)	
	T7	AF-6 (1l/100l water one spray before 72 hours forecast)	
Lay Out	Design	RCBD	
	Treatment	9	
	Replication	3	
	No. of Plants/Replication	15	
	Total Plants	405	
Plan of Work	Six foliar sprays of mentioned chemicals will be applied after every 15 days interval starting from 15th November to 15th February. Data for the frosty night and its intensity will be recorded from monthly meteorological data.		
Parameter	**(Extent of symptom expression for Necrosis on** 1. Bud 2. Leaves 3. Bark		
Results	New Experiment		

2. Plant Pathology Section

2.1 Title	**In-vivo screening of available exotic germplasm of mango against (Mango Quick Wilt Disease) MQWD**			
Objective	To find out tolerant/resistant rootstock against MSD			
Duration	2015-19			
Research Worker	Mr. Muhammad Tariq Malik			
Location	Mango Research Institute, Multan			
Treatments	**Treatment**	**Description**		
	T1	Direct inoculation with virulent strain of *C. manginecans*		
	T2	Control (No inoculation)		
2016	T3	Inoculation with *Lasiodiplodia theobroamae*		
2016	T4	Inoculation with *C. manginecans* + *L. theobroamae*		
Lay Out	Lay out Design	CRD		
	No. of treatment	04		
	No. of replications	03		
	Experimental unit	01		
Plan of Work	This experiment will be conducted in the lath house containing the facilities for the measurement of humidity and temperature level. The seedling mango will be raised in the polyethylene bags containing the standardized media, the bud woods of the required polyembryonic varieties will be collected and grafted on seedling mango after the establishment of their root system in pot media and attaining the suitable size for grafting. The scion will be inoculated with the active culture of virulent strain of *C. manginecans* through making incision of 1.5cm and these will be wrapped with cellophane tape. After some days these wraps will be opened and the symptoms will be observed on leaves, twigs and whole plants with specific intervals.			
Parameters	The following symptoms expressions on different parts of the experimental plants with 0-3 rating scale will be recorded. **Leaves:** Necrosis, Withering, Yellowing, Drying **Stem:** Gummosis Cankers. Lesions, Drying			
Results	**Minimum extent of symptom expression (%) on leaves in different polyembryonic varieties of mango**			
	Sr. No	**Symptoms Expression**	**Variety**	**Average (%)**
	01	Necrosis	Gratidge, 13-1, Elephant Tusk, Xoai Toung, Carabao Lamao, Bullock Hearts	1.00
	02	Withering	R2E2, XOAI Toung	0.33
	03	Yellowing	Elephant Tusk, Rosa	0.33
	04	Drying	Bullock Hearts, Carabao Lamao	0.00
	05	Leathering	Gratidge	0.66
		Minimum extent of symptom expression (%) on stem in different polyembryonic varieties of mango		
	Sr.	**Symptoms**	**Variety**	**Average (%)**

	No	**Expression**		
	01	Gummosis	Brown Seedling, Kasturi, Banana Long, Carabao Lamao, Bullock Hearts	0
	02	Canker	All varieties	0
	03	Dieback	Gratidge, Kasturi, Carabao Lamao, Bullock Hearts	0
	04	Wilting	Bullock Hearts	0
	05	Lesion	Sapa, Kasturi, Banana Long, Carabao Lamao, Bullock Hearts	0
	06	Drying	Bullock Hearts	0
	Gratidge, Carabao Lamao and Bullock Hearts were examined with the least symptom expressions on leaves as well as on stem. However, other varieties like R2E2, Xoai Toung, Elephant Tusk, Rosa and 13-1 showed the minimum extent of symptoms on leaves. Similarly, Kasturi, Banana Long also reflected no sign on the stem. Hence, it is very clear from this table that Gratidge, Carabao Lamao and Bullock Hearts may be used as tolerant rootstock for the control of Mango Quick Wilt Disease (MQWD).			

2.2 Title	**Effect of different chemicals to induce flowering and control of flower diseases in mango Cv. S.B. Chaunsa**		
Objective	To check the effect of different chemicals to enhance flowering, to evaluate the efficacy of different fungicides for the control of flower diseases and to assess the working efficiency of these chemicals with their possible combinations in subtle environmental conditions		
Duration	2015-17		
Research Worker	Mr. Muhammad Tariq Malik		
Location	Mango Research Institute, Multan.		
Treatments	**Treatment**	**Chemicals**	**Dose**
	T_1	KNO_3	1%
	T_2	$Ca(NO_3)_2$	1%
	T_3	$Cu(OH)_2$	250g/100 L
	T_4	Cabrio top	150g/100 L
	T_5	Contaf Plus	150ml/100 L
	T_6	KNO_3+ $Cu(OH)_2$	
	T_7	$Ca(NO_3)_2$+ $Cu(OH)_2$	
	T_8	KNO_3 + Cabrio Top	
	T_9	$Ca(NO_3)_2$ + Cabrio Top	
	T_{10}	KNO_3 + Contaf Plus	
	T_{11}	$Ca(NO_3)_2$ + Contaf Plus	
	T_{12}	Control(unsprayed plants)	
Lay Out	Design	Randomized complete block design	
	No. of treatments	12	
	No. of replications	03	

	No. of plants/ treatment	01
	Total no. of plants	36
Plan of Work	Firstly, the chemicals and fungicides will be tested in the laboratory through making their solutions and mixing with each other to observe their compatibility/congeniality with each other. The compatibility/congeniality test will be completed with the observation of precipitation or any other reaction with the emission of heat etc. In field before doing the spray 40 panicles (10 on each side of the plant) showing swollen buds will be tagged at random on each experimental plant. The mentioned chemicals and fungicides will be tested for their efficacy alone and with their possible combinations through spraying before breaking of the buds.	
Parameters	The data regarding the bud break showing the flowering terminals (%) and natural incidence (%) of apical necrosis, blossom blight and powdery mildew will be recorded with the observation of already tagged inflorescence. The disease intensity (%) of each disease will also be calculated through observing the disease severity by adopting the standardized severity scale for each disease	
Results		

Compatibility of different chemicals and fungicides solutions tested in laboratory

Treatments	Chemical	pH	Reaction
T_1	KNO_3	8.34	0.0
T_2	$Ca(NO_3)_2$	7.69	0.0
T_3	$Cu(OH)_2$	8.01	0.0
T_4	Cabrio top	7.68	0.0
T_5	Contaf Plus	8.13	0.0
T_6	KNO_3+ $Cu(OH)_2$	8.24	0.0
T_7	$Ca(NO_3)_2$+ $Cu(OH)_2$	8.10	0.0
T_8	KNO_3 + Cabrio Top	8.30	0.0
T_9	$Ca(NO_3)_2$ + Cabrio Top	8.11	0.0
T_{10}	KNO_3 + Contaf Plus	7.90	0.0
T_{11}	$Ca(NO_3)_2$ + Contaf Plus	8.12	0.0
T_{12}	Control(unsprayed plants)	-	-

Phytotoxic effect and flower emergence increase on mango cv. S.B. Chaunsa after spraying different chemicals

Treatments	Chemical	Phytotoxicity	Flower Terminal	Times increase over control
T_1	KNO_3	0.0	8.67	5.51
T_2	$Ca(NO_3)_2$	0.0	7.33	4.51
T_3	$Cu(OH)_2$	0.0	5.33	3.00
T_4	Cabrio top	0.0	4.00	2.00
T_5	Contaf Plus	0.0	3.67	1.75
T_6	KNO_3+ $Cu(OH)_2$	0.0	6.66	4.00
T_7	$Ca(NO_3)_2$+ $Cu(OH)_2$	0.0	5.33	3.00
T_8	KNO_3 + Cabrio Top	0.0	4.00	2.00
T_9	$Ca(NO_3)_2$ + Cabrio Top	0.0	5.33	3.00
T_{10}	KNO_3 + Contaf Plus	0.0	5.99	3.50
T_{11}	$Ca(NO_3)_2$ + Contaf Plus	0.0	5.00	2.75
T_{12}	Control(unsprayed plants)	0.0	1.33	-

Disease intensity and decrease percentage of apical necrosis and blossom blight on mango cv. S.B. Chaunsa after spraying different chemicals

		Apical necrosis	Blossom blight

Treatments	Chemical	Intensity %	Decrease %	Intensity %	Decrease %
T_1	KNO_3	0.05	37.50	0.02	71.40
T_2	$Ca(NO_3)_2$	0.03	62.50	0.02	71.40
T_3	$Cu(OH)_2$	0.01	87.50	0.01	85.71
T_4	Cabrio top	0.02	75.00	0.02	71.40
T_5	Contaf Plus	0.03	62.50	0.00	100.00
T_6	KNO_3+ $Cu(OH)_2$	0.02	75.00	0.03	57.14
T_7	$Ca(NO_3)_2$+ $Cu(OH)_2$	0.03	62.50	0.02	71.40
T_8	KNO_3 + Cabrio Top	0.05	37.50	0.03	57.14
T_9	$Ca(NO_3)_2$ + Cabrio Top	0.01	87.50	0.01	85.71
T_{10}	KNO_3 + Contaf Plus	0.02	75.00	0.01	85.71
T_{11}	$Ca(NO_3)_2$ + Contaf Plus	0.07	12.50	0.01	85.71
T_{12}	Control(unsprayed plants)	0.08	-	0.07	-

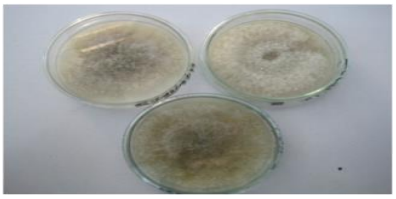
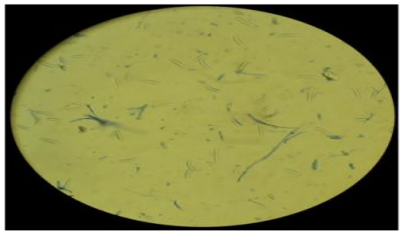
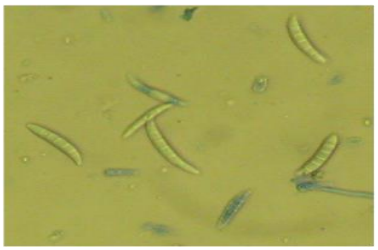
Generally, it is concluded that KNO_3 or $Ca(NO_3)_2$ may be used as flower inducing /dormancy breaking chemicals in mango along with the fungicides preferably $Cu(OH)_2$, if the appropriate control of apical necrosis and blossom blight is simultaneously required with the profuse and early flowering.

2.3 Title	**Isolations, identifications and preservation of the associated fungi with mango plants to maintain culture bank**		
Objective	To maintain cultures of different known and new pathogens for further studies.		
Duration	2012-onward		
Research Worker	Mr. Muhammad Tariq Malik		
Location	Mango Research Institute, Multan		
Plan of Work	During the survey of the mango orchards, diseased samples from symptomatic plants will be collected and analyzed in the laboratory according to the standardized protocols. Further, samples provided by the mango growers will be entertained if the symptoms are confusing. The Pathogenicity test of newly identified microorganisms will also be conducted for confirmation of capability to cause the disease		
Results	**Sr. #**	**Culture Preserved**	**Status**
	1	*Fusarium mangiferae*	Isolated from malformed panicles and isolated from **mango inflorescence midge**
	2	*Colletotrichum gloeosporioides*	Isolated from leaves and fruits showing anthracnose symptoms as it is an established pathogen of mango. Recently isolated from **mango hopper**, **Blow fly and Wasp** (pollinator)
	3	*Ceratocystis manginecans*	Isolated from wilted mango plants, nursery **potting mix** and **panicles** as it has been recently declared as cause of MQWD
	4	*Nattrassia mangiferae*	Isolated from leaves showing Chlorosis/ leathery symptoms and potting mixes. Its Pathogenicity on leaves is still under progress

			as its mode of spread on leaves is new
	5	*Pseudomonas syringae*	This bacterium was isolated from emerging buds showing necrosis and its Pathogenicity is still to be done but this bacterium is already reported
	6	*Cladosproium spp.*	Isolated from nursery potting mixes
	7	*Alternaria alternata*	Isolated from mango **mealy bug** and mango **hopper**

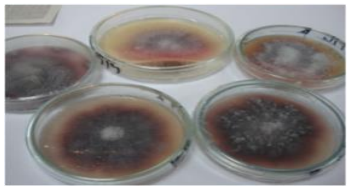
Mango Malformation (*Fusarium mangiferae*)

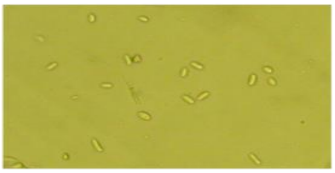


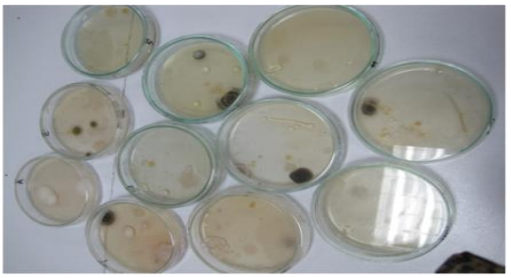
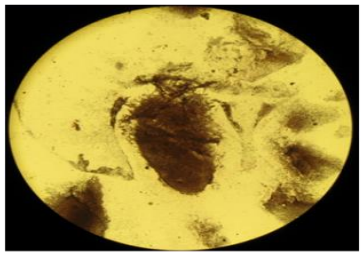
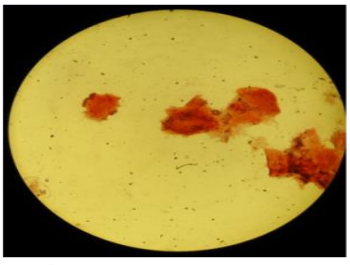

Blossom Blight or Anthracnose (*C. gloeosporioides & A. alternata)*



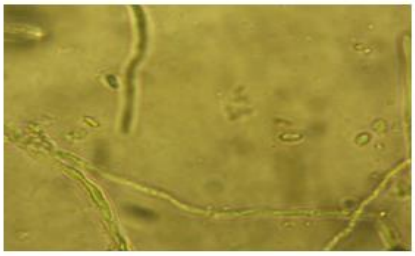


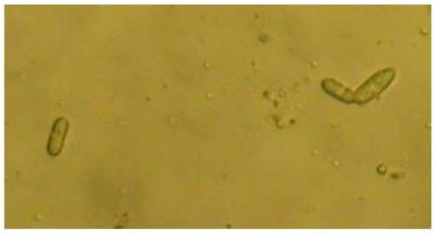

Apical Necrosis as New Observation (*Pseudomonas syringae*)


Leaf Chlorosis/Leathering as new observation (*Nattrassia mangifereae*)







2.4 Title	**Proactive management of Mango Malformation Disease (MMD) through disease escape option**	
Objective	To minimize the infection of MMD through application of NAA and different fungicides during maximum period of infection	
Duration	2016-2018	
Research Worker	Muhammad Tariq Malik	
Location	Mango Research Institute, Multan	
Treatments	**Treatment**	**Description**
	T1	200ppm NAA + Difenoconazol (One spray)
	T2	200ppm NAA + Cabriotop (One spray)
	T3	400ppm NAA + Difenoconazol (One spray)
	T4	400ppm NAA + Cabriotop (One spray)
	T5	200ppm NAA + Difenoconazol (Two spray)
	T6	200ppm NAA + Cabriotop (Two spray)
	T7	400ppm NAA + Difenoconazol (Two spray)
	T8	400ppm NAA + Cabriotop (Two spray)
	T9	Control
Lay Out		
	Design	RCBD
	No. of treatment	09
	No. of replications	03
	Experimental unit	01
	Total number of plants	27
	Design	RCBD
Plan of	1. Tagging of 30 mature terminal shoots on each experiment plant	

Work	2. 1st spray of NAA and fungicides during 1st week of October. 3. 2nd spray of NAA and fungicides during second week of October. 4. Detection of pathogenic fungus from 10 tagged shoots before and after spray.
Parameters	1. Disease incidence will be noted for the next year
Results	New Experiment

2.5 Title	**Developing protocols for clean pot media to establish containerized mango nursery**	
Objective	To observe the infection frequency of soil borne pathogens in potting mix and to standardize the method of its sterilization/pasteurization to make free from contamination	
Duration	2016-2017	
Research Worker	Muhammad Tariq Malik	
Location	Mango Research Institute, Multan	
Treatments	**Treatment**	**Description**
	To	Control
	T1	Steaming with pressure (82◦C at 10lb for 30 minutes)
	T2	Steaming without pressure(30 minutes)
	T3	Heating in oven(82◦C for 30minutes)
	T4	Solarization (65◦C for 6-8 weeks)
	T5	Sterilization with formalin(20ml/l)
	T6	Sterilization with hydrogen peroxide (30ml/l)
Lay Out	Lay out Design	CRD
	No. of treatment	07
	No. of replications	03
	Experimental unit	2kg/treatments/replication
Plan of Work	• Application of all the treatments to the potting mix already in use • Application of all treatments artificially contaminated potting mix • The potting mix (2kg) will be contaminated with one Petri dish (9cm) dissolved in 500ml of water • Determination of soil contaminants before and after treatments through agar slant technique	
Parameters	1. Infestation percentage of different fungi	
Results	New Experiment	

3. Entomology Section

<table>
<tr><td>3.1 Title</td><td colspan="5">Population dynamics of fruit fly (Diptera: Thyphritidae) species associated with different fruits including mango</td></tr>
<tr><td>Objective</td><td colspan="5">To determine the population dynamics of Fruit Fly throughout the year on different fruit crops.
Species identification directly associated with mango</td></tr>
<tr><td>Duration</td><td colspan="5">2014-17</td></tr>
<tr><td>Research Worker</td><td colspan="5">Mr. Abid Hameed Khan and Muhammad Tariq Malik</td></tr>
<tr><td>Location</td><td colspan="5">District Multan</td></tr>
<tr><td>Plan of Work</td><td colspan="5">Monitoring of Fruit Fly:

The traps for monitoring of Fruit Fly was locally made from clean cylindrical recyclable plastic bottles having two square holes on opposite side of bottle for the entry of flies. Traps were hanged at the height of about 2m from ground surface with the help of nylon thread. Grease was applied to the 1/3 proximal part of thread near the branch to prevent ants from preying on Fruit Flies. Attractant used for monitoring was methyl eugenol along with Trichlorfon as killing agent in 10:1.

Six traps were randomly deployed in the field at a distance of 60 m apart to prevent trap inference.

Collection and identification of trap catches:

Traps were emptied weekly and insect collection was shifted to the Plant Protection Lab of Mango Research Institute Multan for their counting and identification. The identification was made on the basis of their morphological characters by using taxonomic key.</td></tr>
<tr><td>Parameters</td><td colspan="5">Fruit Fly infestation percentage was examined by observing six traps of Fruit Fly on fortnight basis.</td></tr>
<tr><td rowspan="9">Results</td><td rowspan="2">Month</td><td colspan="2">Total Fruit Fly/Month</td><td colspan="2">Total Fruit Fly/Week</td></tr>
<tr><td>06 Traps</td><td>01 Trap</td><td>06 Traps</td><td>01 Trap</td></tr>
<tr><td>July, 2015</td><td>2212</td><td>368.67</td><td>553.00</td><td>92.17</td></tr>
<tr><td>August</td><td>1320</td><td>220.00</td><td>330.00</td><td>55.00</td></tr>
<tr><td>September</td><td>565</td><td>94.17</td><td>141.25</td><td>23.54</td></tr>
<tr><td>October</td><td>420</td><td>70.00</td><td>105.00</td><td>17.50</td></tr>
<tr><td>November</td><td>76</td><td>12.67</td><td>19.00</td><td>3.17</td></tr>
<tr><td>December</td><td>21</td><td>3.50</td><td>5.25</td><td>0.87</td></tr>
<tr><td>January, 2016</td><td>0</td><td>0.00</td><td>0.00</td><td>0.00</td></tr>
</table>

	February	0	0.00	0.00	0.00
	March	20	3.33	5.00	0.83
	April	64	10.67	16.00	2.67
	May	652	108.67	163.00	27.17
	June	1732	288.67	433.00	72.16

3.2 Title	**Exploitation of quantitative studies pertaining to mango fruit fly**		
Objective	**To ascertain the infestation, species occurrence, losses, cultivar susceptibility and Sex ratio**		
Research Worker	**Abid Hameed Khan, Muhammad Tariq Malik**		
Duration	**2016-19**		
Location	**Mango Research Institute, Multan**		
Treatments	**Module**	**Activities**	
	1	Rearing of maggots from the infested fruits harvested from tree	
	2	Rearing of the maggots from the infested fruits collected from ground	
	3	T1 +T2 with the use of methyl Eugenol	
Lay Out	Varieties	Sindhri, Chaunsa SB and Chaunsa White	
	Layout design	RCBD	
	No. of Modules	3	
	No. plants per module	5	
	Total No. of plants	15 for each variety	
	Varieties	Sindhri, Chaunsa SB and Chaunsa White	
Plan of work	This study will be conducted through adopting the standard method using Methyl Eugenol to assess the infestation and species occurrence. The fallen fruits under each experimental plant will also be collected on daily bases for the same purpose. Susceptibility level for each variety will be examined with the keen observation of apparently infested fruits on the tree followed by the dissection and rearing in the laboratory.		
Parameters	1. Infestation percentage 2. Variations in symptoms expressions at sting stage 3. Duration of the active period on each variety 4. Cultivar susceptibility 5. Species identification		

<table>
<tr><td></td><td colspan="3">6. Sex ratio</td></tr>
<tr><td>Results</td><td colspan="3">New Experiment</td></tr>
<tr><td>3.3 Title</td><td colspan="3">Identification of the new complex emerging insect pests in mango orchards and their chemical management</td></tr>
<tr><td>Objective</td><td colspan="3">To identify new insect pests viz. Fruit borer, leaf webber and tip borer which are very much confusing with each other and to find out the effective insecticide to control them.</td></tr>
<tr><td>Research Worker</td><td colspan="3">Abid Hameed Khan, Javed Iqbal, Atif Iqbal</td></tr>
<tr><td>Duration</td><td colspan="3">2016-19</td></tr>
<tr><td>Location</td><td colspan="3">Mango Research Institute, Multan</td></tr>
<tr><td>Treatments</td><td>Treatment</td><td colspan="2">Name of insecticide</td></tr>
<tr><td></td><td>T_1</td><td colspan="2">Flubendiamide + thiacloprid (Belt 480 SC) @ 25ml/100L water</td></tr>
<tr><td></td><td>T_2</td><td colspan="2">Gamma cyhalothrin + chlorpyriphos (Bolton 31EC) @ 150ml/100 L water</td></tr>
<tr><td></td><td>T_3</td><td colspan="2">Ammamectin benzoate (Timer 1.9 EC) @ 200ml/100 L water</td></tr>
<tr><td></td><td>T_4</td><td colspan="2">Chlorantraniliprol (Coragen 20 SC) @50 ml/100L water</td></tr>
<tr><td></td><td>T_5</td><td colspan="2">Control</td></tr>
<tr><td>Lay Out</td><td colspan="2">Design</td><td>RCBD</td></tr>
<tr><td></td><td colspan="2">Treatments</td><td>05</td></tr>
<tr><td></td><td colspan="2">Replication</td><td>03</td></tr>
<tr><td></td><td colspan="2">No. of Plants/Treatments</td><td>03</td></tr>
<tr><td></td><td colspan="2">Total No. of plants</td><td>45</td></tr>
<tr><td></td><td colspan="2">Variety</td><td>White Chaunsa</td></tr>
<tr><td>Plan of work</td><td colspan="3">Immature and mature fruits showing holes and frass on the experimental trees will be monitored and examined especially when the two fruits will make contact with each other or grouping. Two sprays of each insecticide will be done on immature and mature stages of the fruits. The infestation percentage before and after each spray will be recorded accordingly to calculate the decrease in infestation percentage. Other cultural practices like pruning of malformed panicles, eradication of weeds under the canopy and skirting of the soil touching branches will be done in each treatment as constant factor.

Collection of the infested samples, rearing of various stages of insect pests in laboratory and identification of the pest on the basis of morphological characters will remain as the integral part of the study.</td></tr>
<tr><td>Parameters</td><td colspan="3">1. Damage symptoms
2. Duration of the active period
3. Feeding mechanism
4. Correlation with environmental factors</td></tr>
</table>

	5. Hibernating places / mechanism 6. Decrease in infestation percentage
Results	New Experiment

4. POST-HARVEST SECTION

<table>
<tr><td>4.1 TITLE</td><td colspan="3">STANDARDIZATION OF MATURITY INDICES OF PROMISING MANGO VARIETIES</td></tr>
<tr><td>OBJECTIVE</td><td colspan="3">To find out the appropriate harvesting time to produce quality fruits</td></tr>
<tr><td>RESEARCH WORKER</td><td colspan="3">Maqbool Ahmad</td></tr>
<tr><td>PROJECT DURATION</td><td colspan="3">2016-18</td></tr>
<tr><td>LOCATION</td><td colspan="3">Mango Research Institute, Multan</td></tr>
<tr><td rowspan="5">TREATMENTS</td><td>Treatments</td><td>Varieties</td><td>Maturity Stages (Days)</td></tr>
<tr><td>T1</td><td>Alishan</td><td>90, 100, 110 and 120</td></tr>
<tr><td>T3</td><td>Late Sindhri</td><td>100, 110, 120 and 130</td></tr>
<tr><td>T4</td><td>MRI-1</td><td>110, 120, 130 and 140</td></tr>
<tr><td>T2</td><td>Azeemu</td><td>120, 130, 140 and 150</td></tr>
<tr><td rowspan="7">LAY OUT DESIGN</td><td colspan="2">Design</td><td>CRD Factorial</td></tr>
<tr><td colspan="2">Treatment-Factor 1</td><td>4</td></tr>
<tr><td colspan="2">Treatment-Factor 2</td><td>4</td></tr>
<tr><td colspan="2">Replication</td><td>3</td></tr>
<tr><td colspan="2">No. of fruits/Replication</td><td>15</td></tr>
<tr><td colspan="2">No. of fruits/variety</td><td>180</td></tr>
<tr><td colspan="2">Total No. of fruits/variety</td><td>720</td></tr>
<tr><td>PLAN OF WORK</td><td colspan="3">Already standardized cultural practices and plant protection measures will be adopted in the experimental units throughout the year. The fruits of the required varieties will be harvested at different intervals as per design after fruit setting. The fruits will be kept for ripening at ambient conditions.</td></tr>
<tr><td>DATA TO BE COLLECTED</td><td colspan="3">Data regarding the following quality parameters will be recorded.
1. Growing Degree (°Days)
2. Skin and pulp color
3. Fruit weight (g)
4. Pulp (%)
5. Specific gravity
6. Dry matter
7. Firmness
8. TSS (°B)
9. Acidity (%)</td></tr>
</table>

Results: 2016

Treatment	Maturity Stage	Fruit Weight g	Firmness kg	Dry Matter %	Pulp%	TSS%		Acidity %	Shelf Life (d)
T_1	D_1 29-Jun	240	10.6	23.3	68.7	8.9	19.7	0.24	9
	D_2 12-Jul	**252**	**8.9**	**24.1**	**70.09**	**9.6**	**22.7**	**0.23**	**9**
	D_3 21-Jul	253	8.4	24.8	71.11	10.3	22.7	0.21	8
	D_4 30-Jul	258	6.8	25.2	71.45	11.6	22.9	0.20	7
T_2	**D_1 12-Jul**	374	12.8	24.2	78.02	6.3	15.8	0.23	9
	D_2 21-Jul	410	11.3	24.8	78.77	6.8	16.3	0.20	9
	D_3 30-Jul	423	9.8	25.6	78.93	7.4	17.5	0.18	8
	D4 8 Aug	**424**	**9.2**	**25.9**	**78.93**	**7.6**	**17.5**	**0.18**	**8**
T_3	**D_1 21-Jul**	376	12.2	23.7	68.36	7.4	14.7	0.22	10
	D_2 30-Jul	402	11.1	25.8	70.08	7.7	16.9	0.20	10
	D_3 8-Aug	**420**	**10.9**	**26.9**	**71.0**	**8.2**	**17**	**0.19**	**9**
	D_4 16-Aug	426	8.5	27.2	71.0	8.9	17	0.18	6
T_4	**D_1 30-Jul**	255	13.0	24.2	65.03	6.7	19.1	0.26	11
	D_2 8-Aug	265	11.3	26.1	68.16	7.2	21.9	0.23	11
	D_3 16-Aug	**270**	**9.9**	**26.9**	**69.16**	**8.6**	**22.6**	**0.22**	**10**
	D_4 25-Aug	274	8.9	26.5	69.38	9.7	22.8	0.22	10

<table>
<tr><td>4.2 TITLE</td><td colspan="4">Determination of post-harvest losses in mango supply chain</td></tr>
<tr><td>OBJECTIVE</td><td colspan="4">To estimate the quantitative and qualitative post-harvest losses in traditional domestic supply chain</td></tr>
<tr><td>RESEARCH WORKER</td><td colspan="4">Maqbool Ahmad</td></tr>
<tr><td>PROJECT DURATION</td><td colspan="4">2017-2020</td></tr>
<tr><td>LOCATION</td><td colspan="4">Mango Research Institute, Multan</td></tr>
<tr><td rowspan="6">TREATMENTS</td><td rowspan="2">Treatments</td><td colspan="2">Factor-1</td><td>Factor-2</td></tr>
<tr><td colspan="2">Practice</td><td>Varieties</td></tr>
<tr><td>T1</td><td colspan="2">Traditional Harvest + Traditional Packing + Traditional Transport</td><td>Sindhri</td></tr>
<tr><td>T2</td><td colspan="2">Improved Harvest + Traditional Packing + Traditional Transport</td><td>Chaunsa SB</td></tr>
<tr><td>T3</td><td colspan="2">Improved Harvest + Improved Packing + Traditional Transport</td><td>White Chaunsa</td></tr>
<tr><td>T4</td><td colspan="2">Improved Harvest + Improved Packing + Improved Transportation</td><td></td></tr>
<tr><td rowspan="8">LAY OUT DESIGN</td><td colspan="2">Design</td><td colspan="2">RCBD</td></tr>
<tr><td colspan="2">Treatment-Factor 1</td><td colspan="2">4</td></tr>
<tr><td colspan="2">Treatment-Factor 2</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Replication</td><td colspan="2">3</td></tr>
<tr><td colspan="2">No. of Trees /Treatment</td><td colspan="2">3</td></tr>
<tr><td colspan="2">No. of Fruit Crates/Replication</td><td colspan="2">2</td></tr>
<tr><td colspan="2">No. of Fruit Crates/Variety</td><td colspan="2">72</td></tr>
<tr><td colspan="2">Total No. of Fruit Crates</td><td colspan="2">216</td></tr>
<tr><td>PLAN OF WORK</td><td colspan="4">Three trees will be selected in the orchard of progressive farmer. Fruit will be harvested, packed, and transported by adopting traditional practices. On other hand in improved practice, fruit will be harvested, packed, and transported according to the improved practices. The fruit crates will be stacked over Truck/Mazda at different levels (Top, Mid and Bottom) and transported to wholesale market (at least 150 km away from orchard). Then these crates will be brought back to MRI Post-harvest laboratory to evaluate the quantity and quality loss. A pilot study will also be conducted to check the affect of short stemming with objective to conserve the latex into the fruits regarding the appearance of post-harvest diseases.</td></tr>
<tr><td>DATA TO BE COLLECTED</td><td colspan="4">Data will be recorded regarding:
Quantitative parameters
1. Weight Loss (%)
2. Physical damage (%)
3. Product Loss (%)
Qualitative parameters (Rating Scale)
1. Sap Injury
2. Sap contamination
3. Abrasion
4. Compression
5. Skin color</td></tr>
<tr><td>RESULTS</td><td colspan="4">New Trial</td></tr>
</table>

5. Plant Nutrition Section

<table>
<tr><td>5.1 Title</td><td colspan="3">Effect of pre flowering and pre harvest foliar spraying of some macro and micro nutrients on mango cv. Chaunsa SB</td></tr>
<tr><td>Objective</td><td colspan="3">To compare the effect of foliar applied calcium nitrite, potassium nitrate and potassium citrate alone and in combination with boric acid on fruit retention, ripening, shelf-life and yield of mango Cv. Chaunsa SB</td></tr>
<tr><td>Duration</td><td colspan="3">2015-17</td></tr>
<tr><td>Research Worker</td><td colspan="3">Mr. Iftikhar Ahmed, Fatma Bibi</td></tr>
<tr><td>Location</td><td colspan="3">Mango Research Institute, Multan.</td></tr>
<tr><td rowspan="10">Treatments</td><td>Treatment</td><td colspan="2">Description</td></tr>
<tr><td>T1</td><td colspan="2">Control</td></tr>
<tr><td>T2</td><td colspan="2">Foliar application of Boric Acid 0.20%</td></tr>
<tr><td>T3</td><td colspan="2">Foliar application of Boric Acid 0.2% + Ca (NO3)21.00%</td></tr>
<tr><td>T4</td><td colspan="2">Foliar application of Boric Acid 0.2% + $CaCl_2$1.00%</td></tr>
<tr><td>T5</td><td colspan="2">Foliar application of Boric Acid 0.2% + K-Citrate1.00%</td></tr>
<tr><td>T6</td><td colspan="2">Foliar application of Boric Acid 0.2% + K_2SO_4 1.00%</td></tr>
<tr><td>T7</td><td colspan="2">Foliar application of Boric Acid 0.2% + KNO_3 1.00%</td></tr>
<tr><td colspan="3">Recommended dose of N, P and K (1500, 1000 and 1000 grams/plant/year respectively) will be applied to all experimental units.</td></tr>
<tr><td rowspan="5">Lay Out</td><td colspan="2">Design</td><td>RCBD</td></tr>
<tr><td colspan="2">No. of treatment</td><td>07</td></tr>
<tr><td colspan="2">No of replications</td><td>04</td></tr>
<tr><td colspan="2">No of plants/Rep. (experimental unit)</td><td>01</td></tr>
<tr><td colspan="2">Total No. of plants</td><td>28</td></tr>
<tr><td>Plan of Work</td><td colspan="3">▪ Soil samples will be collected from the canopy area of the tree from 0-15 and 15-30 cm soil depth before application of treatments (mid October). The samples will be analyzed in Lab following standard procedures.
▪ Fifth and sixth leaf from the apex of 5-6 months old branch will be collected. The collected leaves will be washed with distilled water, dried under shade and kept in oven at 70° C for drying. Finally, the samples will be prepared for analysis of N, P and K.
▪ For determination of boron, plant samples will be dry ashed at 550° C in muffle furnace
▪ The treatments will be applied as foliar spray at pre flowering and at pre-harvest stage of fruit with the help of tractor mounted Jecto Sprayer.</td></tr>
<tr><td>Parameters</td><td colspan="3">1. Fruit retention percentage
2. Fruit Weight (g)
3. Yield per plant (Kg)
4. Shelf Life
5. SER
6. Total soluble solids (Brix°)</td></tr>
</table>

	7. Acidity (%) 8. Plant tissue analysis for N, P and K before start of experiment and after fruit harvest.
Results	

Treatment	Fruit Set (No/Panicle)	Fruit retention %	Fruit Volume (cm3)	Fruit weight (g)	Yield/Plant (kg)
T1	28g	0.39e	185b	197c	98d
T2	31e	0.42de	209a	221bc	106d
T3	35d	0.54c	208a	247ab	130bc
T4	30f	0.43de	180b	232abc	121c
T5	37c	0.48d	207a	239abc	126bc
T6	40b	0.64b	207a	254ab	138ab
T7	42a	0.88a	210a	264a	149a

Treatment	TSS (Brix°)	Acidity (%)	Shelf life (Days)	SER Incidence after 10 days
T1	17.1c	0.29a	8d	39.50a
T2	18.9bc	0.27b	9c	29.00d
T3	21.4ab	0.21d	11b	33.50c
T4	19.9b	0.26b	9cd	37.00b
T5	20.4ab	0.24c	10bc	35.00c
T6	23.1a	0.20d	13a	25.50e
T7	22.8a	0.15d	12da	23.75f

5.2 Title	**Effect of pre-harvest spray of antioxidants along with micronutrients on post-harvest shelf life and quality of mango cv. Chaunsa White**	
Objective	To evaluate the effect of some antioxidants (Ascorbic acid and Citric acid alone and in combination with micronutrients mixture (Zn, Cu, Fe and Mn) as foliar application on fruit retention, yield and fruit quality of mango Cv. Chaunsa White.	
Duration	2015-17	
Research Worker	Mr. Iftikhar Ahmed, Fatma Bibi	
Location	Mango Research Institute, Multan.	
Treatments	**Treatment**	**Description**
	T1	Control
	T2	Foliar application of Citric Acid @1000ppm
	T3	Foliar application of Ascorbic Acid @1000ppm
	T4	Foliar application of Citric Acid @1000ppm + (Zn, Cu, Fe

		and Mn) @0.15%
	T5	Foliar application of Citric Acid @1000ppm + (Zn, Cu, Fe and Mn) @ 0.30%
	T6	Foliar application of Ascorbic Acid @1000ppm + (Zn, Cu, Fe and Mn) @ 0.15%
	T7	Foliar application of Ascorbic Acid @1000ppm + (Zn, Cu, Fe and Mn) @ 0.30%
	Recommended dose of N, P and K (1500, 1000 and 1000 g/plant/year respectively) will be applied to all experimental units.	

Lay Out	Design	RCBD
	No. of treatment	07
	No of replications	04
	No of plants/Rep. (experimental unit)	01
	Total No. of plants	28

Plan of Work

- Soil samples will be collected from the canopy area of the tree from 0-15 and 15-30 cm soil depth before application of treatments (mid October). The samples will be analyzed in Lab following standard procedures.
- Fifth and sixth leaf from the apex of 5-6 months old branch will be collected. The collected leaves will be washed with distilled water, dried under shade and kept in oven at 70◦ C for drying. Finally, the samples will be prepared for analysis of N, P and K.
- For determination of Micronutrients, plant samples will be wet digested with nitric acid and perchloric acid.
- The treatments will be applied as foliar spray at pre flowering and at marvel stage of fruit with the help of tractor mounted Jecto Sprayer.

Parameters

1. Fruit Set (%)
2. Fruit Weight(g)
3. Yield/plant (Kg)
4. Shelf Life at ambient conditions (Days)
5. SER (%)
6. Total Soluble Solids (Brix◦)
7. Acidity (%)
8. Plant tissue analysis for N, P and K

Results

Treatment	**TSS%**	**Acidity%**	**Shelf Life (Days)**	**SER incidence after 10days**
T1	17.0d	0.28a	7d	51a
T2	20.8c	0.26ab	8c	49b
T3	21.1c	0.24bc	10c	41d
T4	23.8b	0.21d	11b	36e
T5	26.3a	0.19e	13a	31f
T6	21.7c	0.22cd	9c	45c
T7	22.2bc	0.25bc	8c	50ab

<table>
<tr><td>5.3 Title</td><td colspan="3">Responses of boron application times on mango fruit setting, retention and fruit quality in mango Cv. Chaunsa White</td></tr>
<tr><td>Objective</td><td colspan="3">To evaluate the effect of application times of B, on fruit setting, retention, and reducing sugar contents in mango plants. Boron will be applied at bud initiation, fruit setting and pre harvest stage of fruit through soil and foliar application</td></tr>
<tr><td>Duration</td><td colspan="3">2017-18</td></tr>
<tr><td>Research Worker</td><td colspan="3">Mr. Iftikhar Ahmed, Fatma Bibi</td></tr>
<tr><td>Location</td><td colspan="3">Mango Research Institute, Multan.</td></tr>
<tr><td rowspan="9">Treatments</td><td>Treatment</td><td colspan="2">Description</td></tr>
<tr><td>T1</td><td colspan="2">Control</td></tr>
<tr><td>T2</td><td colspan="2">Foliar spray of Boric Acid 0.08 % before bud initiation</td></tr>
<tr><td>T3</td><td colspan="2">Foliar spray of Boric Acid 0.08 % before fruit setting</td></tr>
<tr><td>T4</td><td colspan="2">Foliar spray of Boric Acid 0.08 % pre harvest of fruit</td></tr>
<tr><td>T5</td><td colspan="2">Soil application of Boric Acid 60g/plant before bud initiation</td></tr>
<tr><td>T6</td><td colspan="2">Soil application of Boric Acid 60g/plant before fruit setting</td></tr>
<tr><td>T7</td><td colspan="2">Soil application of Boric Acid 60g/plant pre harvest of fruit</td></tr>
<tr><td colspan="3">Recommended dose of N, P and K (1500, 1000 and 1000 g/plant/year respectively) will be applied to all experimental units.</td></tr>
<tr><td rowspan="5">Lay Out</td><td colspan="2">Design</td><td>RCBD</td></tr>
<tr><td colspan="2">No. of treatment</td><td>07</td></tr>
<tr><td colspan="2">No of replications</td><td>04</td></tr>
<tr><td colspan="2">No of plants/Rep. (experimental unit)</td><td>01</td></tr>
<tr><td colspan="2">Total No. of plants</td><td>28</td></tr>
<tr><td>Plan of Work</td><td colspan="3">▪ Soil samples will be collected from the canopy area of the tree from 0-15 and 15-30 cm soil depth before application of treatments (mid October). The samples will be analyzed in Lab following standard procedures.
▪ Before the start of experiment
▪ Healthy leaves at 15 days after treatment application
▪ Five days before harvest
N, P, K and B will be analyzed from the leaf samples</td></tr>
<tr><td>Parameters</td><td colspan="3">1. Fruit Set (%)
2. Fruit Weight(g)
3. Yield/plant (Kg)
4. Shelf Life at ambient conditions (Days)
5. SER (%)
6. Total Soluble Solids (Brix◦)
7. Acidity (%)</td></tr>
</table>

	8. Plant tissue analysis for N, P and K 9. Reducing Sugar%
Results	**New Experiment**

5.4 Title	**STANDARDIZATION OF NUTRITIONAL REQUIREMENTS OF DIE BACK AFFECTED PLANTS Cv. CHAUNSA SB WITH INTEGRATED APPROACH**	
Objective	1. To rehabilitate the diseased plants with chemical and organic fertilizer through improving nutrient use efficiency (NUE) 2. To develop the yardstick for the application of nutrients according to disease intensity	
Duration	2016-18	
Research Worker	F. Bibi, I. Ahmed, M. T. Malik and Hameedullah	
Location	Mango Research Institute Multan and farmer field	
Treatments	**Treatment**	**Description**
	T1	RD of NPK
	T2	RD of NPK + FYM
	T3	RD of NPK + City Waste
	T4	RD of NPK + Poultry Manure
	T5	RD of NPK + Press Mud
Lay Out	Design	RCBD
	No. of treatment	05
	No of replications	04
	No of plants/Rep. (experimental unit)	01
	Total No. of plants	20
Plan of Work	▪ Plants of the same age showing different disease intensity levels will be selected ▪ Application of NPK during the months of July- August and Feb- March after soil and leaf analysis respectively ▪ Organic sources will be added on the basis of organic matter contents during the month of December ▪ Supplementation of micronutrients as foliar spray after leaf analysis during Feburaury ▪ Treatment of saline and saline-sodic soils accordingly ▪ Adoption of other cultural practices for required mango crop production	
Parameters	Disease intensity before and after treatment will be recorded with the relevant disease scoring scale	
Results	**New Experiment**	