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FOR THE

YEAR

2017-18

AGRONOMIC RESEARCH INSTITUTE
AARI, FAISALABAD

OVERVIEW

Agronomy is a fountain-head of all the disciplines of agricultural sciences. It plays radical role in food production and food security as well as bridging over the gap in demand and supply of food. As the agro-environmental conditions in Punjab differ, therefore, in order to cater for the requirements of different ecological zones of Punjab, Agronomic Research Institute, Faisalabad was established during 1984 with four stations each at Farooqabad, Karor, Khanewal and Bahawalpur. The main focus of this Institute is to provide results of agronomic research on different field crops to the farming community through framing and developing comprehensive and adoptable production technologies. These production technologies have not only improved per acre yield of different field crops but also raised the living standard of the farming community. The current threat of abrupt climate change throughout the globe has changed the priorities of Agricultural Research institutes. Therefore, in order to re-orientate the agronomic research, different research trials remain in plan to redress the problems of farming community in the perspective of climate change. Strenuous efforts are being made to develop new production technology containing the solutions of the growers in relation to climate change.

Out of forty wheat genotypes screened for drought and heat tolerance under field conditions line No. 49 was found drought and line No. 3 was found heat tolerant. Zinc enriched has been observed in wheat, maize and cucumber crops by the soil and foliar applied zinc. Broadcast of seed and augmented with furrows (ridging) through laser land leveling enhanced the grain yield of wheat (16%). Rice-wheat cropping system showed maximum cost benefit ratio (18%) in Khanewal conditions than cotton-wheat cropping system. Two rows of mungbean between two consecutive rows of cotton produced maximum net return (Rs. 87472/-). Significantly higher seed cotton yield (4780 kg/ha) was recorded with Bt cotton alone than other relaying techniques. Higher seed cotton yield was recorded in ‘cotton by planting on 75 cm apart beds through manual dibbling than other planting techniques. 100 kg of vermicpompost were collected. Transplantation of 30 days old rice nursery gave higher paddy yield (4237 kg ha^{-1}) than other sowing methods. Out of thirty lines of Quinoa, UAF-S-21 produced maximum panicle length (84 cm) than UAF-S-23 (57.33 cm). 3rd week of October and 1st week of November showed higher yield of lentil under thal (444 kg ha^{-1}) and irrigated conditions (1097 kg ha^{-1}). Maximum garlic yield (15.675 tons ha^{-1}) was recorded by the application of FYM and sugar press mud @ 5 t ha^{-1} than other organic sources. Maximum seed yield (3500 kg ha^{-1}) of canola was obtained from 15th September sown crop under Faisalabad conditions. The pre- emergence application of Pert Plus 96 EC @ 2250 mL ha^{-1} gave better weed control in cotton than standard Topmax 96 EC applied @ 2250 mL ha^{-1}. However, results of the research work carried out during 2017-2018 are elaborated briefly as under:

PLANT PHYSIOLOGY SECTION

TITLE-1: WATER USE EFFICIENCY EVALUATION OF DIFFERENT SOWING METHODS OF RICE

The experiment was conducted at Research area of Plant Physiology Section, Ayub Agricultural Research Institute, Faisalabad during 2017 to assess the water use efficiency of rice under different sowing methods. The experiment was laid out in Randomized Complete Block Design having a plot size of one 15 m × 30m. Basmati-515 was used as a test variety. Plant to plant and row to row distance of 22.5 cm was maintained. NPK @ 150-100-100 kg ha^{-1} was applied. Whole of the P, K and half of the N was applied at sowing. Remaining N was applied through split doses. All other agronomic practices were kept uniform. The following results were met during course of studies:

Table: Effect of sowing methods on water use efficiency and other agronomic parameters

#	Treatments	Chlorophyll fluorescence (Fv/Fm)	Plant Height (cm)	Number of tillers (m^{-2})	Number of kernels per panicle	1000-Kernel weight (g)	Paddy yield (Kg ha^{-1})	WUE (kg mm^{-1})
1	Dry Seeding (Drill)	0.769	95.67	316.33 b	121b	21.94 c	2523 c	1.15
2	Wattar Seeding (Drill)	0.767	110.67	330.67 b	132 ab	22.52 bc	2882 b	1.36
3	SRI System of Rice intensification (15 days old nursery)	**0.780**	120	360.67 ab	**153 a**	23.37 ab	4064 a	2.38
4	Transplanting Conventional (30 days old nursery)	0.760	**122.67**	**404.33 a**	**153 a**	**24.33 a**	**4237 a**	**2.82**
	LSD	**0.038 (NS)**	**13.85 (NS)**	**51.32**	**29.22**	**1.13**	**271.56**	**-**

Chlorophyll fluorescence (Fv/Fm)

It is evident from the data given in the table that chlorophyll fluorescence was not affected significantly by various seeding methods of rice. However, maximum chlorophyll fluorescence (0.780) was recorded in System of Rice Intensification (SRI).

Number of tillers (m^{-2})

The data regarding number of tillers m^{-2} presented in the table showed that the maximum tillers m^{-2} (404.33) was produced under transplanting (conventional) followed by SRI (System of Rice Intensification). Whereas the minimum no. of tillers m^{-2} (247) was produced in dry seeding (Drill).

Number of kernels per panicle

The data regarding number of kernels per panicle presented in the table showed that the maximum number of kernels per panicle (153) were produced under transplanting (conventional) and SRI (System of Rice Intensification). Whereas the minimum number of kernels per panicle (121) was produced in dry seeding (drill).

1000-kernal weight (g)

The data regarding number of kernels per panicle presented in the table showed that the maximum 1000-kernal weight (24.33g) was produced under transplanting (conventional). Whereas the minimum 1000-kernal weight (21.94 g) was produced in dry seeding (Drill).

Paddy yield(kg ha^{-1})

The data regarding paddy yield presented in the table showed that the maximum paddy yield (4237 kg ha^{-1}) was recorded in transplanting (conventional). Whereas, the minimum paddy yield (2523 kg ha^{-1}) was produced in dry seeding (Drill).

Water Use Efficiency (kg mm^{-1})

The data regarding water use efficiency presented in the table showed that the maximum water use efficiency (2.82kg mm^{-1}) was recorded in transplanting (conventional). Whereas the minimum water use efficiency (1.15kg mm^{-1}) was recorded in dry seeding (drill).

TITLE-2: SCREENING OF NEW HERBICIDES FOR RICE

This trial was conducted on July 2017 with the objective to screen out new herbicides for weed control in rice crop. Trial was conducted by using Randomized Complete Block Design having three replications. Three new pre-emergence herbicide formulations viz. Fast –Mix 60 EW (Butachlor), Kelion 50 WG (Orthosulfamuron), Council Activ 30 WG (Triafamone + Ethoxysulfuron methyl) and one new post-emergence herbicide Apiro Forte 55.08 SC (Pyriftalid + Bensulfuron methyl) were tested against pre-emergence Machete 60 EC (Butachlor), Rifit 500 EC (Pertilachlor), Kelion 50 WG (Orthosulfamuron) and post-emergence Pyranex 60 WDG (Bispyrabac + Bensulfuron).The following results were obtained during this year of study:

Table: Effect of herbicides on weed count and paddy yield

#	Herbicides	Dose ha^{-1}	Weed Counts (m^2)						Paddy yield (kg ha^{-1})	Increase in yield (%)
			Broad leaf weeds	% Control	Grasses	% Control	Sedges	% Control		

1	*Machete 60 EC (Butachlor)*	2000 mL	1 c	83.33	2 d	90.47	35 a	0.0	4250 abc	63.90
2	*Fast –Mix 60 EW (Butachlor)*	2000 mL	1 c	83.33	1 d	95.23	35 a	0.0	4183 bc	61.31
3	*Kelion 50 WG (Orthosulfamuron)*	150 g	1 c	83.33	2 d	90.47	3 c	85.71	4367 ab	68.41
4	*Council Activ 30 WG (Triafamone + Ethoxysulfuron methyl)*	185 g	1 c	83.33	1 d	95.23	1 c	97.14	4466 a	72.23
5	*Pyranex 30 WDG (Bispyribac sodium + Bensulfuron methyl)*	250 g	1 c	83.33	6 c	71.43	1 c	97.14	4033 c	55.53
6	*Apiro Forte 55.08 SC (Pyriftalid + Bensulfuron methyl)*	400 mL	2 b	66.66	10 b	52.38	14 b	60.00	2800 d	7.98
7	Control (weedy check)	-	6 a	-	21 a	-	35 a	-	2593 d	-
		LSD	**0.57**		**3.45**		**4.33**	**-**	**276.78**	-

Weed Counts (m^{-2}) It is evident from the weed counts data that the pre-emergence candidate herbicide Fast -Mix 60 EW (Butachlor) gave weed control at par with the standard herbicide Machete 60 EC (Butachlor) but both were ineffective against *Cyperus rotundus* (Deela). The other candidate herbicide Kelion 50 WG and Council Activ 30 WG not only controlled Broad leaf weed and grasses but eliminated *Cyperus rotundus* (Deela) effectively as well. Council Activ 30 WG was the best performer overall. The post emergence candidate herbicide Apiro Forte 55.08 SC (Pyriftalid+bensulfuron) gave poor performance and its weed control was significantly lesser than the standard herbicide Pyranex 60 WDG (Bispyrabac sodium + bensulfuron) at the recommended dose.

Paddy yield (kg ha^{-1})

It is evident from the data that the pre-emergence candidate herbicides viz. Fast -Mix 60 EW (Butachlor), Kelion 50 WG (Orthosulfamuron) and Council Activ 30 WG (Ethoxy sulfuron + triasamon) gave paddy yield at par with their respective standards viz. Machete 60 EC (Butachlor). The post emergence candidate herbicide Apiro Forte 55.08 SC (Pyriftalid+bensulfuron) gave statistically lesser paddy yield (2800 kg ha^{-1}) than the standard herbicide Pyranex 60 WDG (Bispyrabac sodium +bensulfuron) with paddy yield 4033 kg ha^{-1}.

TITLE-3: BIOFORTIFICATION OF MAIZE BY ZINC APPLICATION

The experiment was conducted at Research area of Plant Physiology Section, Ayub Agricultural Research Institute, Faisalabad during 2017 to assess the Zinc nutrient enrichment of maize by bio- fortification. The treatments comprised of T_1Control (No soil application, No foliar spray),T_2(Soil application of Zinc sulphate @ 15 kg ha^{-1}),T_3 (Foliar spray of Zinc sulphate @ 1.0% at 5th leaf, tasseling and grain formation stages) and T_4 (Foliar spray of Zinc sulphate @

Table: Effect of Zinc application on maize grain yield and yield parameters

#	Treatments	Chlorophyll fluorescence (Fv/Fm)	Plant Height (cm)	No. of grains per cob	1000-grains weight (g)	Biological yield (Kg ha^{-1})	Grain yield (Kg ha^{-1})	Harvest index (%)	Bio-available zinc (mg/kg)
1	Control (No spray and no soil application)	0.697 c	**256.67**	600.33	257.51	30135 c	7326 c	24.31	22.41 b
2	Soil Application of zinc sulphate @ 15 kg /ha	0.717 c	253.33	566.66	287.32	31958 b	7970 b	24.94	31.03 ab
3	Foliar spray of zinc sulphate @ 1%	0.745 b	254.33	**613.33**	292.75	31973 b	8110 b	**25.47**	35.48 ab
4	Foliar spray of zinc sulphate @ 2%	**0.776 a**	245.67	606.66	**295.65**	**34870 a**	**8499 a**	24.39	**39.12 a**
LSD		**0.0221**	**15.33 (NS)**	**90.61 (NS)**	**45.84 (NS)**	**736.39**	**315.30**	**1.33 (NS)**	**11.19**

2.0% at 5th leaf, tasseling and grain formation stages). The experiment was laid out in Randomized Complete Block Design with a plot size measuring 3.0 m × 8.0 m. It was replicated four times and maize variety Pioneer FH-810 was used as test variety. Sowing was done with hand drill using seed @ 25 kg ha^{-1} with row to row distance of 75 cm. Plants were thinned out to maintain plant to plant distance of 25 cm and fertilizers @ 200-100-100 NPK kg ha^{-1} was applied at sowing to all the treatments. All other agronomic practices including weed control, irrigation and pest management measures were adopted uniformly. The following results were recorded during course of studies:

Chlorophyll contents (Fv/Fm)

It is evident from the data presented in table that maximum chlorophyll contents (0.776) were attained in treatment where foliar sprays of Foliar spray of Zinc sulphate @ 2.0% at 5th leaf, tasseling and grain formation stages were applied. The minimum chlorophyll contents (0.697) were attained in treatment control with no spray.

Plant height (cm)

The maximum plant height (256.57 cm) was achieved in Control where No spray and no soil applicationwas applied. The minimum plant height (245.67 cm) was achieved in treatment wherefoliar sprays of Foliar spray of Zinc sulphate @ 2.0% at 5th leaf, tasseling and grain formation stages were applied. Statistically, difference among plant height was non-significant.

Grains per cob

The maximum no. of grains per cob (613.33) was achieved in treatment T_3 (Foliar spray of Zinc sulphate @ 1.0% at 5th leaf, tasseling and grain formation stages) was applied. The minimum no. of grains per cob (566.66) was achieved in T_2 (Soil application of Zinc sulphate @ 15 kg ha^{-1}).

Biological yield (kg ha^{-1})

Significantly the highest biological yield (34870 kg ha^{-1}) was achieved in treatment T_4 (Foliar spray of Zinc sulphate @ 2.0% at 5th leaf, tasseling and grain formation stages) followed by (31973) T_3 (Foliar spray of Zinc sulphate @ 1.0% at 5th leaf, tasseling and grain formation stages). The minimum biological yield (30135 kg ha^{-1}) was achieved in control treatment where No spray and no soil applicationwas applied.

Grain yield (kg ha^{-1})

Significantly the highest grain yield (8499 kg ha^{-1}) was achieved in treatment T_4 (Foliar spray of Zinc sulphate @ 2.0% at 5th leaf, tasseling and grain formation stages) and followed by (8110kg ha^{-1}) T_3 (Foliar spray of Zinc sulphate @ 1.0% at 5th leaf, tasseling and grain formation stages). The minimum grain yield (7326kg ha^{-1}) was achieved in control treatment where no spray and no soil application was applied.

Harvest index (%)

The highest harvest index (25.47%) was achieved in treatment T_3 (Foliar spray of Zinc sulphate @ 1.0% at 5th leaf, tasseling and grain formation stages). The minimum harvest index (24.31%) was achieved in control treatment. Overall results were non-significant.

Bio-available Zinc (mg/kg)

The highest concentration of bio-available Zinc (39.12 mg/kg) was achieved in treatment T_4 (Foliar spray of Zinc sulphate @ 2.0% at 5th leaf, tasseling and grain formation stages). The minimum concentration of bio-available Zinc (22.41 mg/kg)was achieved in control.

TITLE-4: TESTING OF NEW HERBICIDES FOR MAIZE

The trial was shown on August 2016 with the objective to find out new herbicides for effective control of weeds in maize crop. The trial was sown along the 75 cm wide ridges and variety FH-810 was used as testing variety. It was conducted in Randomized Complete Block design having a plot size of 3.0 m × 8.0 m. Pre-emergence herbicide formulation i.e. Voltril 63 SC (Atrazine + Mesotrione + S- metolachlor),Twist 55 SC (Atrazine + Mesotrione), Topmax 96 EC

(Pendimethalin +Metolachlor), Arch 74 EC (Pendimethalin +S-Metolachlor) and Burton 960 EC (Pendimethalin +Metolachlor) were tested against its standard Primextra gold 720 SC (Atrazine + S-metolachlor). Also two new post emergence herbcides formulations viz. Maxpro 80 WDG (Atrazine + Mesotrione + Halosulfuron methyl) and Twist 55 SC (Atrazine + Mesotrione) were tested against their standard herbicide Primextra gold 720 SC(Atrazine + S-metolachlor). The following results were recorded during this year of study.

Table: Effect of different herbicides on weed count and grain yield of maize

#	Name of herbicides	Dose ha^{-1}	Weed density (m^2)						grain yield (kg ha^{-1})
			Broad leaf weeds	% control	Grasses	% control	Sedges	% control	
1	*Primextra gold 720 SC (Atrazine + S-metolachlor)*	2000 mL	1 c	95.65	1 d	92.86	7 cd	50.0	**6466 d**
2	*Voltril 63 SC (Atrazine + Mesotrione + S- metolachlor)*	2500 mL	2 b	91.30	1 d	92.86	5 de	64.28	**6585 bcd**
3	*Twist 55 SC (Atrazine + Mesotrione)*	1250 mL	2 b	91.30	1 d	92.86	8 bc	42.86	**6424 d**
4	*Topmax 96 EC (Pendimethalin +Metolachlor)*	2250 mL	1 c	95.65	1 d	92.86	3 e	78.57	**6775 b**
5	*Arch 74 EC (Pendimethalin +S-Metolachlor)*	1500 mL	1 c	95.65	1 d	92.86	4 de	71.43	**6669 bc**
6	*Burton 960 EC (Pendimethalin +Metolachlor)*	1500 mL	1 c	95.65	1 d	92.86	4 de	**71.43**	**6558 cd**
7	*Primextra gold 720 SC (Atrazine + S-metolachlor)*	1000 mL	1 c	95.65	12 ab	14.29	11 ab	21.43	**6970 a**
8	*Maxpro 80 WDG (Atrazine + Mesotrione + Halosulfuron methyl)*	875 g	1 c	95.65	5 c	64.28	2 e	85.71	**6585 bcd**
9	*Twist 55 SC (Atrazine + Mesotrione)*	1250 mL	1 c	95.65	11 b	21.43	10 b	28.57	**6513 cd**
10	Control		23 a	-	14 a	-	14 a	-	**4570 e**
		LSD	**0.56**		**2.02**		**3.05**		**191.80**

Weed Counts (m^{-2})

The data regarding weed count after 25 days of spray showed that all herbicides, both candidates and standard gave maximum weed control against all weeds. Minimum weed control was noted in weedy check plot.

Grain Yield (kg ha^{-1})

Highest maize grain yield (6970 kg ha^{-1}) was recorded in treatment where Maxpro 80 WDG @ 875 g ha^{-1} was sprayed, followed by Topmax 96 EC (6775 kg ha^{-1}). Which was at par with treatments, where Voltril 63 SC, Arch 74 EC and Maxpro 80 WDG were applied. The lowest grain yield of 4570 kg ha^{-1} was produced in case of control plot.

TITLE-5: SCREENING OF NEW HERBICIDES FOR SUGARCANE

The trial was sown in March, 2017 to screen out new herbicides to control weeds in sugarcane crop. Seven herbicidesi.eScope 80 WP *(Ametryn + Atrazine)* @ 2500 g ha^{-1},Dafli 80 WDG *(Atrazine + Mesotrione + Halosulfuron methyl)* @ 1750 g ha^{-1},Dual gold 960E (*S-metolachlor)*@ 2500mL ha^{-1}, Voltril 63 SC *(Atrazine + Mesotrione + S metolachlor)*@ 2500 mL ha^{-1}, Twist 55 SC*(Atrazine + Mesotrione)*@ 2000 mL ha^{-1}, Maxpro 80WDG *(Atrazine + Mesotrione + Halosulfuron methyl)* @ 62.5g, and Primextra gold 720 SC *(Atrazine + S-metolachlor)* @ 2000 mL ha^{-1} were tested along with Hand Weeding and Control (Weedy Check) to control broad leaf weeds, grasses and sedges. Cane variety HSF-240 was used as a test material. The trial was laid out in Randomized Complete Block Design having 3 replications with a plot size of 3.0 m × 8.0 m. The following results were recorded:-

Table: Effect of herbicides on weed counts and cane yield

#	Name of herbicides	Dose ha^{-1}	Weed density (m^2)						Cane yield* (t ha^{-1})
			Broad leaf weeds	% control	Grasses	% control	Sedges	% control	
1	*Scope 80 WP (Ametryn + Atrazine)*	2500 g	2 c	96.55	4 ef	90.90	11 de	88.04	90.93 bc
2	*Dafli 80 WDG (Atrazine + Mesotrione + Halosulfuron methyl)*	1750 g	2 c	96.55	5 ef	88.63	27 c	70.65	97.67 b
3	*Dual gold 960E S-metolachlor*	2500 mL	2 c	96.55	2 f	95.45	13 de	85.86	87.0 c
4	*Voltril 63 SC (Atrazine + Mesotrione + S metolachlor)*	2500 mL	5 bc	91.37	17 c	38.63	14 d	84.78	89.0 c
5	*Scope 80 WP (Ametryn + Atrazine)*	2500 g	4 bc	93.10	6 ef	86.36	27 c	70.65	84.11 c
6	*Dafli 80 WDG Atrazine + Mesotrione + Halosulfuron methyl*	1750 g	2 c	96.55	6 ef	86.36	35 b	61.95	86.67 c
7	*Maxpro 80WDG (Atrazine + Mesotrione + Halosulfuron methyl)*	62.5 g	6 bc	89.65	21 b	52.27	35 b	61.95	87.33 c
8	*Primextra gold 720 SC(Atrazine + S-metolachlor)*	2000 mL	2 c	96.55	15 cd	65.90	16 d	82.60	83.66 c
9	*Twist 55 SC (Atrazine + Mesotrione)*	2000 mL	2 c	96.55	14 cd	68.18	14 d	84.78	84.11 c
10	*Voltril 63 SC* + hand weeding	2500 mL	7 b	87.93	12 d	**72.72**	15 d	83.69	89.89 c
11	Hand weeding (Thrice)		4 bc	93.10	4 ef	90.90	8 e	91.30	108.00

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12	Control (Weedy check)	**58 a**	-	44 a	**-**	92 a	-	47.98 d
	LSD	**4.87**	**-**	**3.63**	**-**	**5.18**	**-**	**7.75**

Weed Counts (m^{-2})

It is evident from the table that all the herbicides obviously provided better weed control as compared to weedy check in sugarcane crop. Amongst the pre-emergence herbicides candidate Dual gold 960E @ 2500 mLha^{-1} provided 96.55%, 95.45% and 85.86 % control of broad leaf weeds, grasses and sedges respectively. As for as post-emergence herbicides are concerned candidate herbicide Twist 55 SC@ 2000mL ha^{-1} provided 96.55% , 68.18% and 84.78% control of broad leaf weeds, grasses and sedges as compared with standard herbicide Scope 80% WP@ 2500 g ha^{-1} which provided 93.10% control of broad leaf weeds and 86.36 % of grasses and 70.65 % of sedges, respectively. The lowest weed control was recorded in control treatment (weedy check).

Cane Yield (t ha^{-1})

Among pre-emergence herbicides, maximum cane yield (97.67 t ha^{-1}) was produced by Dafli 80 WDG @ 1750 g ha^{-1}which almost double than control (47.98 t ha^{-1}). Among post emergence candidate herbicides Voltril 63 SC @ 2500 mL ha^{-1}produced maximum cane yield (89.89 t ha^{-1}). It was concluded that all the pre and post emergence herbicides significantly increased cane yield over untreated plots(49.98 t ha^{-1}) by controlling weeds in sugarcane crop.

TITLE-6: TESTING OF NEW HERBICIDES FOR COTTON

This trial was conducted to find out new herbicides for effective weed control in cotton crop. The trial was sown on May 2017 in Randomized Complete Block Design having a plot size of 3.0 m × 8.0 m. Cotton variety FH-Lalazar was used in the study. New pre-emergence herbicide *Pert Plus 96 EC (S-Metolachlor + Pendimethaline)* was tested to control cotton weeds with standard *Topmax 96 EC (Metolachlor + Pendimethaline)*@ 2250 mL ha^{-1}respectively. Also one new post-emergence herbicide viz. *Fusilade 125 EC (Fluzifop-P-Butyl)*@ 3200 mL ha^{-1} was tested along with standard Percept 10.8 EC @ 875 mL ha^{-1}. The following results were met during this year of study.

Table: Effect of herbicides on weed counts, weed biomass, seed cotton yield and CBR

Treatments	**Dose ha^{-1}**	**Weed counts (m^{-2}), % control and dry weed biomass (gm^{-2})**						**Ave. boll weight (g)**	**Yield kg ha^{-1}**	**CBR**
		Broad Leaf weeds	**Bio-mass**	**Grasses**	**Bio-mass**	**Sedges**	**Bio-mass**			
Topmax 96 EC (Metolachlor + Pendimethaline)	2250 mL	9 c (87.14 %)	93.44 c	11 c (83.58%)	41.39 d	7 c (87.50 %)	20.47 c	4.03 b	2258 a	1:1.68
Pert Plus 96 EC (S-Metolachlor + Pendimethaline)	2250 mL	8 c (88.57 %)	83.23 c	10 c (85.07%)	32.12 e	6 c (89.28 %)	14.90 c	4.11 a	2294 a	1:1.70

Percept 10.8 EC (Haloxyfop-P-methyl)	875 mL	38 b (45.71 %)	138.14 b	19 b (71.64%)	69.40 b	32 b (42.85 %)	63.52 b	3.57 d	1646 c	1:1.42
Fusilade 125 EC (Fluzifop-P-Butyl)	3200 mL	36 b (48.57 %)	112.65 bc	13 c (80.59%)	53.29 c	31 b (44.64 %)	60.07 b	3.69 c	1787 b	1:1.51
Control (weedy check)		70 a	309.39 a	67 a	98.46 a	56 a	85.73 a	2.98 e	1266 d	1:1.12
	LSD	**4.84**	**36.39**	**4.33**	**5.99**	**6.11**	**7.97**	**0.079**	**109.62**	**-**

Weeds count (m^{-2})

It is obvious from the data that pre-emergence candidate herbicide Pert plus 96 EC @ 2250 mL ha^{-1} gave broad leaf weed control (8.0) and also control over grasses (10.0) statistically at parwith its standard Topmax 96 EC @ 2250 mL ha^{-1}. Both the herbicides (standard & candidate) were also found effective against *Cyperusrotundus* (Deela). Similarly, post-emergence candidate herbicide Fusilade 125 EC (Fluzifop-P-Butyl) @ 3200 mL ha^{-1} gave poor control over Broad leaf weeds and sedges as compare to pre-emergence standard and candidate herbicides but results were at par with post-emergence standard herbicide Percept 10.8 EC @ 875 mL ha^{-1}.

Average boll weight (g)

It is clear from the data that Pert plus 96 EC @ 2250 mL ha^{-1}produced significantly higher average boll weight of 4.11 g against its standard Topmax 96 EC @ 2250 mL ha^{-1} which produced average boll weight of 4.03 g.. Candidate herbicideFusilade 125 EC@ 3200 mL ha^{-1} gave higher average boll weight of 3.69as compared to its standard which produced average boll weigh of 3.57 g. The lowest average boll weight (2.98 g) was recorded in control (weedy check).

Seed cotton yield (kg ha^{-1})

It is clear from the data that pre-emergence candidate herbicide Pert plus 96 EC @ 2250 mL ha^{-1} produced higher (2294 kg ha^{-1}) but statistically at par seed cotton yield with its standard Topmax 96 EC @ 2250 mL ha^{-1} which produced (2258 kg $ha^{-1)}$. Post emergence candidate herbicide Fusilade 125 EC@ 3200 mL ha^{-1} produced higher seed cotton yield (1887 kg ha^{-1}) against the standard herbicide Percept 10.8 EC (1646 kg ha^{-1}). The minimum seed cotton yield 1266 kg ha^{-1} was recorded in control where no herbicides were sprayed.

Cost benefit ratio (CBR)

As for as CBR is concerned, highest cost benefit ratio was recorded in pre-emergence candidate herbicide Pert plus @ 2250 mL ha^{-1}i.e., 1:1.70, as compared to its standard Topmax @ 2250 mL ha^{-1} (1:1.68).

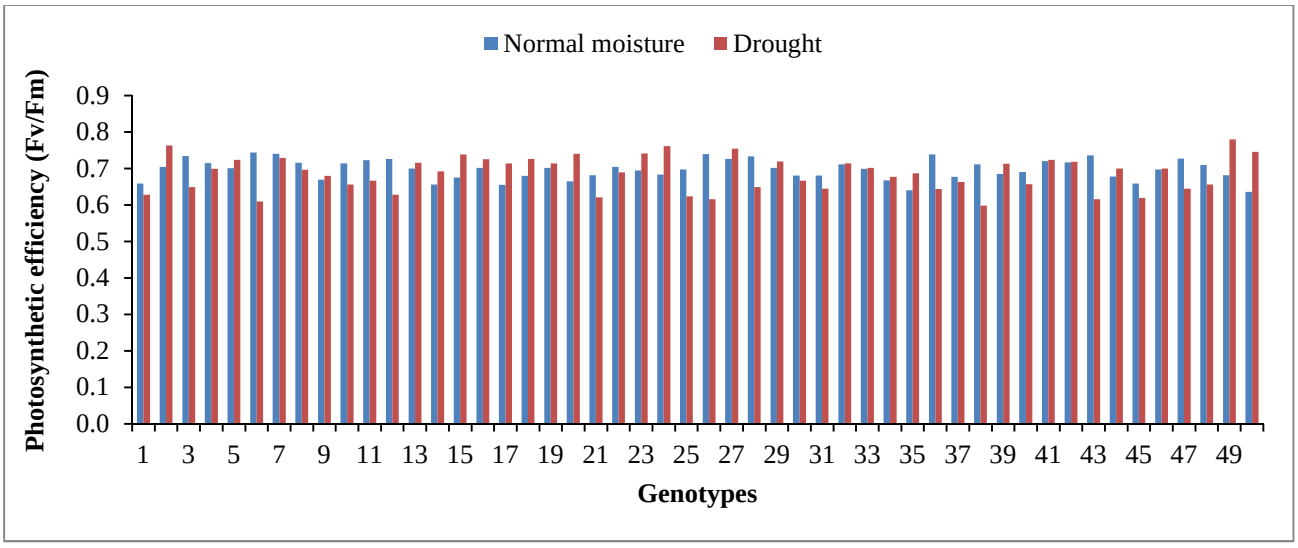
TITLE-7: PHYSIOLOGICAL EVALUATION OF WHEAT GENOTYPES FOR DROUGHT TOLERANCE

The experiment was conducted at Research area of Plant Physiology Section, Ayub Agricultural Research Institute, Faisalabad during 2017-18 to evaluate the performance of 50

wheat genotypes for drought tolerance. The experiment was laid out in split plot design with three replications keeping plot size 1.8 m × 5.0 m. Treatments including normal moisture (16 acre inches + rainfall) and moisture stress (4 acre inches + rainfall) were placed in main plots whereas 50 lines/genotypes were randomized in sub plots. The crop was sown using dibbling method keeping plant to plant distance of 11.5 cm and row to row distance 22.5 cm. Fertilizer @ 115-85-60 NPK kg ha^{-1} was applied.

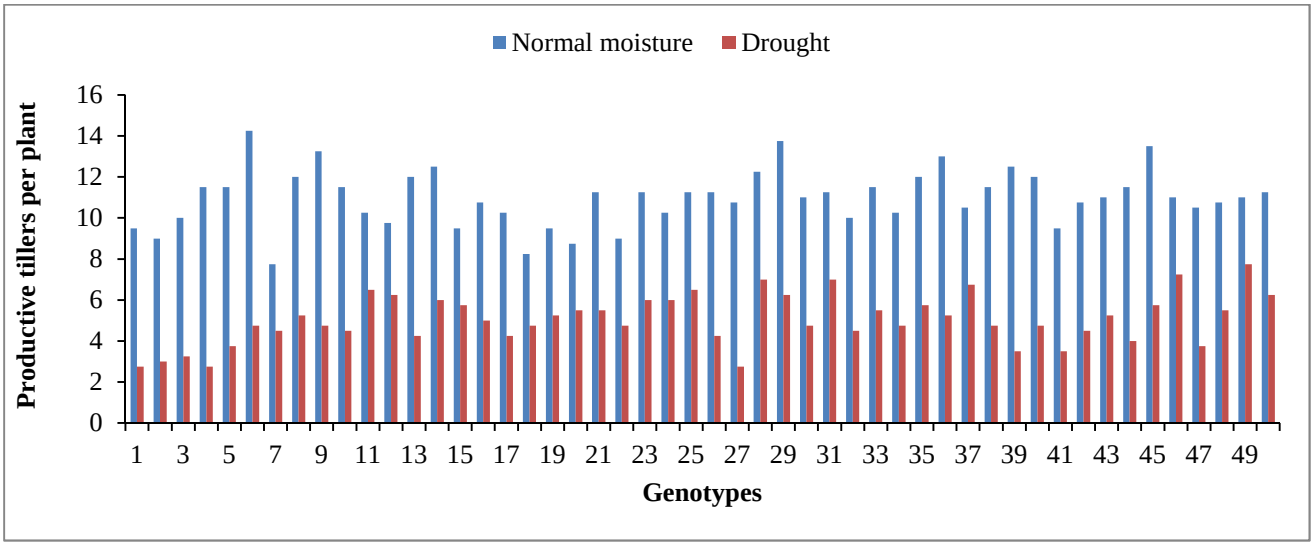
Photosynthetic efficiency of Photosystem II

Photosynthetic efficiency was maximum for plant of line no. 6 whereas minimum photosynthetic efficiency was recorded from plants of line no. 14 under normal moisture conditions. Under drought conditions efficiency of photosystem II was maximum for line number 49 whereas minimum photosynthetic efficiency was recorded from plant of line no. 1.



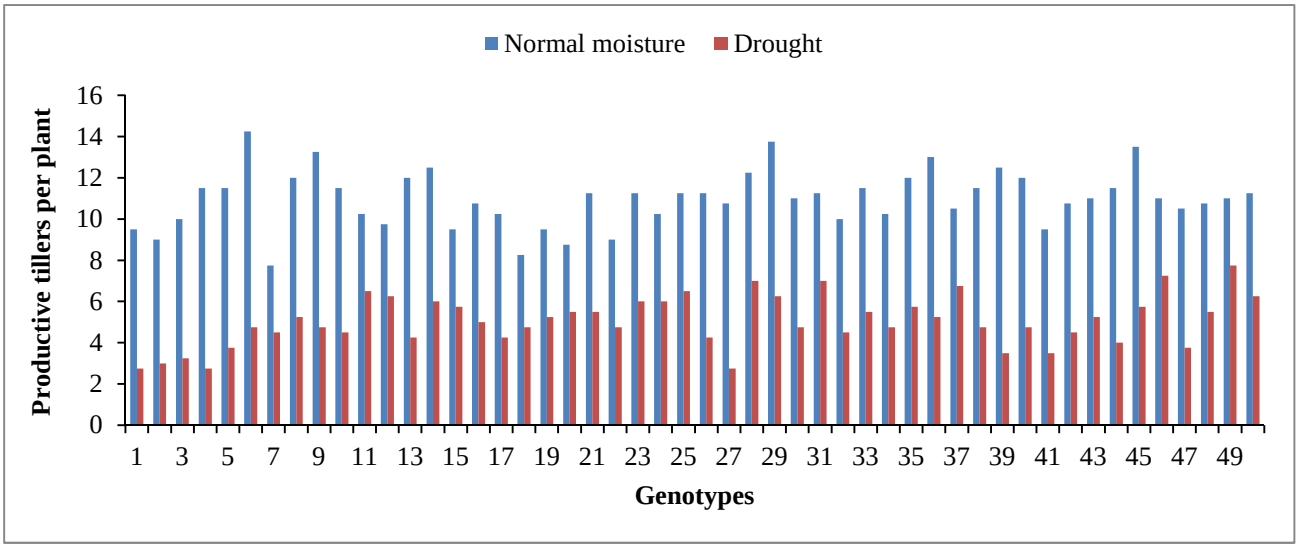
Plant height

Line no. 1 had minimum plant height (80.34 cm) at maturity while maximum plant height (105.03 cm) was recorded from line no. 12 under normal moisture conditions. Under drought conditions maximum plant height (74.21 cm) was recorded for line no. 38 while minimum plant height (52.28 cm) was produced by line no. 1.



Productive tillers

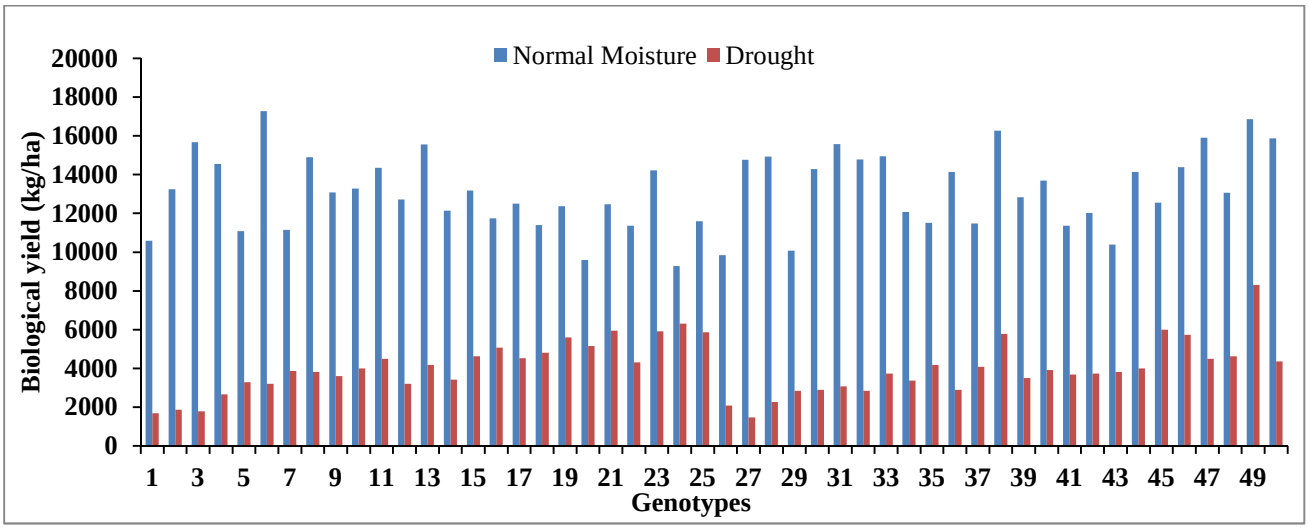
Maximum number of productive tillers per plant was recorded for line no. 6 while minimum numbers of productive tillers were recorded for line no. 18 under normal moisture conditions. Under moisture stress maximum number of productive tiller per plant were recoded from line no.49 while minimum no. of productive tillers per plant were recorded in line no. 1, 2, 3, 4 and 27.

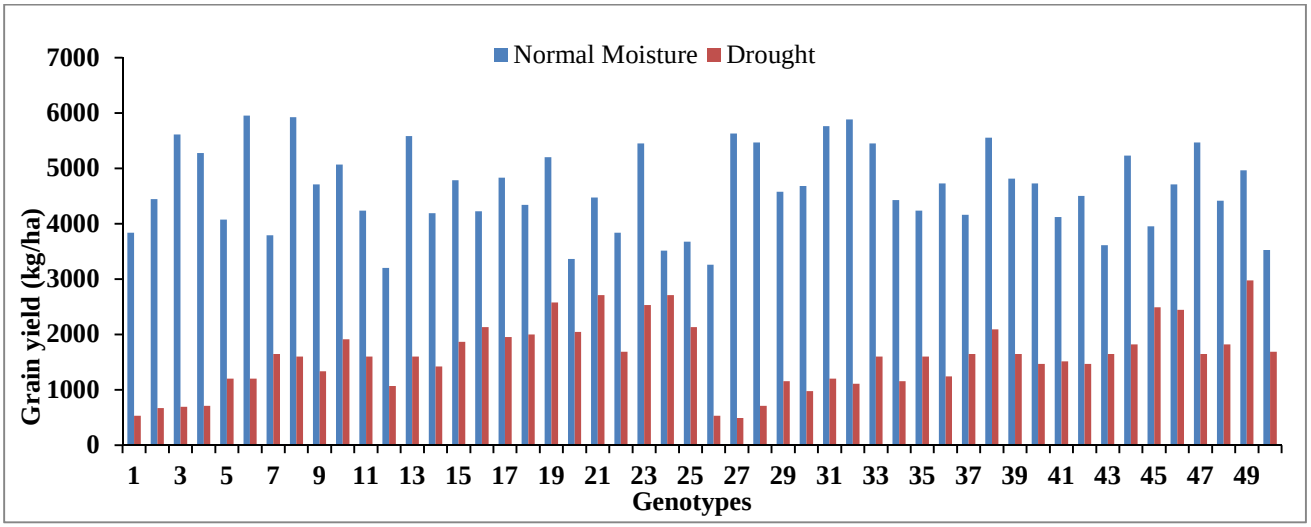


Yield

Maximum grain yield (5956 kg/ha) and biological yield (17221 kg/ha) was recorded for line no. 6 while minimum grain yield (3259 kg/ha) was recorded for line no. 26 whereas

minimum biological yield (9279 kg/ha) was recorded for line no. 24 normal moisture condition. Under drought, maximum grain yield (2978 kg/ha) and biological yield (8311 kg/ha) was recorded for line no.49 whereas minim grain yield (489 kg/ha) and biological yield (1467 kg/ha) was recorded from line no. 27.





TITLE-8: INDUCTION OF HEAT TOLERANCE IN WHEAT BY THE FOLIAR APPLICATION OF OSMOPROTECTANTS

The experiment was conducted at Research Area of Plant Physiology Section, Agronomic Research Institute, Faisalabad during Rabi 2017-18 to study the role of osmoprotectants for inducing heat tolerance in wheat. The following treatments (i) Temperature regime viz. Normal temperature & Under tunnel (Heat stress) and (ii) Osmoprotectants viz. Control (No spray), distilled water @ 250 L ha^{-1}, Magnesium sulphate ($MgSO_4$) @ 2.5 %, Magnesium sulphate @ 5.0 %, Potassium orthophosphate (KH_2PO_4) @ 0.1 %, Potassium orthophosphate (KH_2PO_4) @ 0.2 % and Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1 % were foliar sprayed. The experiment was laid out in split plot design with three replications keeping plot size 2.25 m × 8.0 m. Temperature regimes were kept in main plots whereas osmoprotectants were randomized in sub plots. The crop was sown using rabi drill keeping row to row distance 22.5 cm. Fertilizer @ 115-85-60 NPK kg ha^{-1} was applied.

1000-Grain weight (g)

It was observed that under ambient temperature maximum 1000- grain weight (44.86 g) was recorded where Potassium orthophosphate was applied @ 0.2 % followed by combined application of Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1 % which produced 44.49 g 1000-grain weight Significantly minimum 1000-grain weight (40.48 g) was recorded where no osmoprotectants were sprayed.

On the other hand under heat stress conditions (tunnel), maximum 1000-grain weight (30.77 g) was noted where combined application of Magnesium sulphate @ 2.5 % & Potassium orthophosphate @ 0.1 % was applied which was followed by the application of Potassium orthophosphate was applied @ 0.2 % which produced 1000-grain weight (30.03 g).

Table: Effect of osmoprotectants on 1000-grain weight (g) of wheat

#	Osmoprotectants	1000 grain weight (g)		Mean
		Ambient Temperature	Heat Stress (Under Tunnel)	
1	Control (No spray)	40.48 d	26.14 i	33.06 f
2	Distilled water @ 250 L ha^{-1}	41.05 d	27.25 h	34.15 e
3	Magnesium sulphate @ 2.5 %	42.92 c	28.39 g	35.65 d
4	Magnesium sulphate @ 5 %	43.50 bc	28.86 g	36.18 c
5	Potassium orthophosphate @ 0.1%	43.82 b	29.54 f	36.68 b
6	Potassium orthophosphate @ 0.2%	44.86 a	30.03 f	37.45 a
7	Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1%	44.49 a	30.77 e	37.63 a
	Mean	**43.02 a**	**28.71 b**	-
LSD for Temp. 1.668, LSD for Osmo. 0.436, LSD for Int. 0.616				

Grain yield (kg ha^{-1})

It was concluded that under ambient temperature maximum grain yield (5167 kg ha^{-1}) was recorded where Potassium orthophosphate was applied @ 0.2 % followed by combined application of Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1 % which produced 4933 kg ha^{-1} grain yield. Significantly minimum grain yield (4133 kg ha^{-1}) was recorded where no osmoprotectants were sprayed.

On the other hand under heat stress conditions (tunnel), maximum grain yield (3063 kg ha^{-1}) was recorded where combined application of Magnesium sulphate @ 2.5 % & Potassium orthophosphate @ 0.1 % was applied which was followed by the application of Potassium orthophosphate was applied @ 0.2 % which produced grain yield (3034 kg ha^{-1}).

Table: Effect of osmoprotectants on grain yield of wheat

#	Osmoprotectants	Yield kg ha^{-1}		Mean
		Ambient Temperature	Heat Stress (Under Tunnel)	
1	Control (No spray)	4133 c	2094 h	**3114 e**
2	Distilled water @ 250 L ha^{-1}	4300 c	2350 gh	**3325 d**
3	Magnesium sulphate @ 2.5 %	4800 b	2521 fg	**3661 c**
4	Magnesium sulphate @ 5 %	4717 b	2692 ef	**3705 c**
5	Potassium orthophosphate @ 0.1%	4767 b	2863 de	**3815 bc**
6	Potassium orthophosphate @ 0.2%	5167 a	3034 d	**4100 a**
7	Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1%	4933 ab	3063 d	**3998 ab**
	Mean	**4688 a**	**2660 b**	**-**
LSD for Temp. 116.15, LSD for Osmo. 202.72, LSD for Int. 286.69				

TITLE-9: INDUCTION OF DROUGHT TOLERANCE IN WHEAT BY THE FOLIAR APPLICATION OF OSMOPROTECTANTS

The experiment was conducted at Research Area of Plant Physiology Section, Agronomic Research Institute, Faisalabad during 2017-18 to study the role of osmoprotectants for inducing drought tolerance in wheat. The following treatments (i) Moisture levels viz. Normal moisture (16 acre inches + rainfall) & Moisture stress(4 acre inches + rainfall) and (ii) Osmoprotectants viz. Control (No spray), distilled water @ 250 L ha^{-1}, Magnesium sulphate ($MgSO_4$) @ 2.5 %, Magnesium sulphate @ 5.0 %, Potassium orthophosphate (KH_2PO_4) @ 0.1 %, Potassium orthophosphate (KH_2PO_4) @ 0.2 % and Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1 %, were foliar sprayed. The experiment was laid out in split plot design with three replications keeping plot size 2.25 m × 8.0 m. Moisture levels were kept in main plots whereas osmoprotectants were randomized in sub plots. The crop was sown using rabi drill keeping row to row distance 22.5 cm. Fertilizer @ 115-85-60 NPK kg ha^{-1} was applied.

1000-Grain weight (g)

It was obvious from the data that under normal moisture (16 acre inches + rainfall) conditions significantly maximum 1000- grain weight (43.63 g) was recorded where Magnesium sulphate @ 5 % was applied followed by combined application of Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1 % which produced 41.58 g 1000-grain weight. Significantly minimum 1000-grain weight (39.15 g) was recorded where no osmoprotectants were sprayed.

On the other hand under moisture stress(4 acre inches + rainfall) conditions, significantly maximum 1000-grain weight (29.25 g) was noted where combined application of Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1 % was applied which was followed by the application of Potassium orthophosphate @ 0.2 % which produced 1000-grain weight (28.66g).

Table: Effect of osmoprotectants on 1000-grain weight (g) of wheat

#	Osmoprotectants	1000 grain weight (g)		Mean
		Normal Moisture (16 acre inches + rainfall)	Moisture Stress (4 acre inches + rainfall)	
1	Control (No spray)	39.15 d	26.30 i	32.73 e
2	Distilled water @ 250 L ha^{-1}	39.65 cd	26.75 hi	33.20 de
3	Magnesium sulphate @ 2.5 %	40.91 bc	27.10 ghi	34.01 cd
4	Magnesium sulphate @ 5 %	43.63 a	27.75 fgh	35.69 a
5	Potassium orthophosphate @ 0.1%	40.92 bc	28.25 efg	34.58 bc
6	Potassium orthophosphate @ 0.2%	41.33 b	28.66 ef	34.99 ab
7	Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1%	41.58 b	29.25 e	35.42 ab
	Mean	41.03 a	27.72 b	
LSD for Moisture lev. 2.499, LSD for Osmo. 0.967, LSD for Int. 1.368				

Grain yield (kg ha^{-1})

It was concluded that under both the moisture levels all the osmoprotectants under study significantly influence the grain yield of wheat. Under normal moisture (16 acre inches + rainfall) maximum grain yield (5115 kg ha^{-1}) was recorded where Magnesium sulphate @ 5.0 % was foliar sprayed which was followed by the combined application of Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1 % which produced 4933 kg ha^{-1} grain yield. Significantly minimum grain yield (4205 kg ha^{-1}) was recorded where no osmoprotectants were sprayed.

On the other hand under drought stress (4 acre inches + rainfall), significantly maximum grain yield (3130 kg ha^{-1}) was recorded Potassium orthophosphate @ 0.2 % was applied which was followed by the combined application of Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1% which produced grain yield (2945 kg ha^{-1}).

Table: Effect of osmoprotectants on grain yield of wheat

#	Osmoprotectants	Grain yield (kg ha^{-1})		Mean
		Normal Moisture (16 acre inches + rainfall)	Moisture Stress (4 acre inches + rainfall)	
1	Control (No spray)	4205 d	2235 j	**3220 e**
2	Distilled water @ 250 L ha^{-1}	4400 c	2450 i	**3425 d**
3	Magnesium sulphate @ 2.5 %	4817 b	2570 hi	**3694 c**
4	Magnesium sulphate @ 5 %	5115 a	2720 gh	**3918 ab**
5	Potassium orthophosphate @ 0.1%	4867 b	2840 fg	**3854 b**
6	Potassium orthophosphate @ 0.2%	4915 b	3130 e	**4023 a**
7	Magnesium sulphate @ 2.5 % + Potassium orthophosphate @ 0.1%	4905 b	2945 f	**3925 ab**
	Mean	**4746 a**	**2699 b**	
LSD for Moisture lev. 183.86, LSD for Osmo. 116.17, LSD for Int. 164.28				

TITLE-10: SCREENING OF HERBICIDES TO CONTROL MONOCOT WEEDS IN WHEAT

This experiment was conducted to compare grass killer herbicides for the control of grassy weeds espaciallyy Phalaris minor (Dumbi sittee) in wheat. The experiment was conducted through Randomized Complete Block Design having three replications. Herbicides viz. *Topik 15 WP* clodinofop-propargyl,*Certain plus 14.5 EC* Clodinofop+Fenoxaprop+ Tralkoxydim, *Puma super 75 EW* Fenoxaprop-p-ethyl and *Axial 50 EC* Penoxaden were tested. It was concluded that *Axial 50 EC* gave as the most effective control of grassy weeds. The detail of the results during this year of study is given below:

Weed counts and grain yield as affected by different herbicides

Herbicides	Dose ha^{-1}	Weed 1 Dumbi sittee	Weed 2 Jangli Jai	Weed 3 (Chawli, Bhoin)	Total
T1. *Topik 15 WP* Clodinofop-propargyl	300 g	04 c	00	04 c	08 c
T2. *Certain plus 14.5 EC* Clodinofop+Fenoxaprop+ Tralkoxydim	1250 ml	04 c	00	03 d	07 c
T3. *Puma super 75 EW* Fenoxaprop-p-ethyl	1250 ml	10 b	00	05 b	15 b
T4. *Axial 50 EC*	832 ml	02 d	00	05 b	07 c
T5. control (weedy check)		15 a	09	06 a	30 a
	CD1	0.5	0.7	0.3	1.5

Weed counts m^{-1}:

It is evident from the weed counts data that T4 *Axial 50 EC @* 832 ml and T2. *Certain plus 14.5 EC* @1250 ml gave as the most effective control of grassy weeds each leaving only 07 weeds m^{-1}. These were followed byT1 *Topik 15 WP* @300 g ha^{-1} with 08 weeds m^{-1}. The T3 *Puma super 75 EW* @1250 ml gave the poor weed control and left 15 weeds m^{-1}. As regards the control of individual weeds, T4 *Axial 50 EC @* 832 ml had the edge over other herbicides in controlling *Phalaris minor (Dumbi sittee)* which left only 02 weeds m^{-1}. T3 *Puma super 75 EW* @1250 ml ha^{-1} was found as the poorest weedicide which left 10 weeds m^{-1}. It was deduced from the trial that *Phalaris minor (Dumbi sittee)* has developed more resistance against fenoxaprop. It was further concluded that none of these aryloxyfenoxypropionate group herbicides control *Bromus japonicas (Chavli) and Poa annua (Bhoin* or blue grass).

TITLE-11: RE VARIFICATION OF BIO EFFICACY OF HERBICIDES FOR WEED CONTROL IN WHEAT

This trial was conducted to re verify the bioefficacy of different groups of herbicides being marketed by different agencies. Different formulations of three groups of herbicides viz. broad spectrum, grass killers and dicot weed killers were selected for this study. Out of broad spectrum three herbicides viz. *Atlantis* 3.6 WG, Findus 3.6 WG (Mesosulfuron + iodosulfuron) each @ 400 g ha^{-1} and *Ferary 16 EC (*Fenoxaprop + metribuzin)@ 500 ml ha-1, out of monocot weeds or grass killers *Axial 050 EC* (Penoxaden) @825ml, *Topik 15 WP* (Clodinafop propargyl) @ 300 g, *Sonak 15 WP* (Clodinafop propargyl) @ 300 g and *Skype 20 EC* (Clodinafop propargyl) @ 250 ml ha-1 and out of broad leaf weedicides *Buctril super* 60 EC (Bromoxynil+ MCPA) @ 750 ml, *Selector 60EC* (Bromoxynil+ MCPA) @ 750 ml, Bromoxynil plus MCPA 40EC @ 1250 ml generic, *Starane-M 50EC (*Fluroxypyr + MCPA) @ 750, *Harvester 100+400 g/lit (*Fluroxypyr + MCPA) @ 1000 ml were selected. Out of sulfonylurea group dicot weedicides *Allymax 66.7 WG (*Metsulfuron+ tribenuron) @ 20 g (Syngenta) and *Metafin super 28.6 WG (*Metsulfuron+ tribenuron) 35 g ha^{-1} of Kanzo group were also compared. The following results were met during the 1st year of study:

Effect of herbicides on weed counts m^{-1} and grain yield of wheat

T	Treatments	Weeds m^{-1}	Safety %	Grain Yield Kg ha^{-1}
1	*Atlantis* 3.6 WG (Mesosulfuron + iodosulfuron) @400 g/ha *Bayer*	01 d	85%	4455 a
2	*Findus 3.6WG* (Mesosulfuron + iodosulfuron) @400 8g/ha *Sun Crop*	02 d	85%	4380 a
3	*Ferary 16 EC (*Fenoxaprop + metribuzin) 500 ml *Four Brothers*	13 b	75%	3560 d
4	*Axial 050 EC* (Penoxaden) @825ml/ha *Syngenta Pakistan*	01 d	90%	4230 b
5	*Topik 15 WP* (Clodinafop propargyl) @ 300 g/ha *Syngenta Pakistan*	03 d	90%	3950 c
6	*Sonak 15 WP* (Clodinafop propargyl) @ 300 g/ha *Jaffar Agros*	04 d	90%	3875 c
7	*Skype 20 EC* (Clodinafop propargyl) @ 250 ml/ha *Tara group*	03 d	90%	3860 c
8	*Certain plus* 14.5 EC (Clodinafop+fenoxaprop+tralkoxydim) @1250 ml/ha	03 d	85%	4250 a
9	*Buctril super* 60 EC (Bromoxynil+ MCPA) @ 750 ml/ha *Bayer Pakistan*	03 d	90%	4150 b
10	*Selector 60EC* (Bromoxynil+ MCPA) @ 750 ml/ha *Ali Akbar*	06 c	90%	4100 b
11	Bromoxynil plus MCPA 40EC @ 1250 ml/ha Generic companies	07 c	90%	4000 b
12	*Starane-M 50EC (*Fluroxypyr + MCPA) @ 750 ml/ha *FMC*	01 d	90%	4150 b
13	*Harvester 100+400 g/lit (*Fluroxypyr + MCPA) @ 1000 ml/ha *Kanzo*	01 d	88%	4150 b
14	*Allymax 66.7 WG (*Metsulfuron+ tribenuron) @ 20 g/ha *Syngenta Pakistan*	01 d	90%	4125 b
15	*Metafin super 28.6 WG (*Metsulfuron+ tribenuron) 35 g/ha *Kanzo*	02 d	90%	4025 b
16	Control (weedy check)	49 a	-	2405e
CD 1		**3.5**	**-**	**455**

Broad spectrum Herbicides:

It is evident from the weed counts data that out of broad spectrum weedicides both T1 *Atlantis* 3.6 WG of bayer and *Findus 3.6WG of suncrop each* @400 g/ha gave equally effective weed control i.e; 01 and 02 weeds m-1. They were not only found equally safe on wheat crop but their grain yield was also found non-significant with 4455 and 4380 kg ha^{-1} respectively. T3 *Ferary*

16 EC of Four brothers@ 500 ml not only gave poor weed control, found phytotoxic and grain yield significantly lesser (i.e; 3560 kg ha^{-1}) than T1 *Atlantis* 3.6 WG and T2 *Atlantis* 3.6 WG.

Monocot herbicides:

As regards the comparative performance of monocot or grass killer herbicides *Axial 050 EC* (Penoxaden-Syngenta) @825ml gave as the best weed control which left only 01 weed m^{-1}. Whereas *Topik 15 WP* (Clodinafop propargyl-Syngenta) @ 300 g, *Sonak 15 WP* (Clodinafop propargyl- Jaffar Agros) @ 300 g and *Skype 20 EC* (Clodinafop propargyl- Tara group) @ 250 ml ha-1 gave relatively poor weed control. However , the results of monocot herbicides were found statistically non significant.

Broad leaf herbicides:

As regards the broad leaf weedicides, *Buctril super* 60 EC (Bromoxynil+ MCPA) @ 750 ml/ha of *Bayer* Pakistan gave better weed control i.e; 03 weeds m^{-1} than *Selector 60EC* (Bromoxynil+ MCPA) @ 750 ml/ha of *Ali Akbar group and* Bromoxynil plus MCPA 40EC @ 1250 ml/ha of Generic companies which left 06 and 07 weeds $^{m-1}$ respectively. However these were found equally safe on crop and difference of yield was also found non significant. Likewise, *Starane-M 50EC (*Fluroxypyr + MCPA) @ 750 ml/ha of *FMC* and *Harvester 100+400 g/lit (*Fluroxypyr + MCPA) @ 1000 ml/ha of Kanzo group gave non significant results of weed control and grain yield. Results of the sulfonylurea group weedicides viz. *Allymax 66.7 WG (*Metsulfuron+ tribenuron) @ 20 g of Syngenta and *Metafin super 28.6 WG (*Metsulfuron+ tribenuron) 35 g ha^{-1} of Kanzo group also gave non significants weed

TITLE-12: SCREENING OF PROPER DOSE OF HERBICIDES FOR WEE CONTROL IN VEGETABLES

This trial was sown in vegetables research institute on Nov 01, 2017 with the objective to find out chemical solution of weeds in selected vegetables. The trial was sown having a plot size of 1.5X5 meter (two ridges per treatment and two rows per ridge) in collaboration with VRI Faisalabad

Treatments

Crops: Garlic, onion, peas, radish, turnip, carrot, coriander, cauliflower, fenugreek, spinach and cauliflower

Weedicides: Re emergence herbicides viz. Stomp 455 g/l CS (Pendimethalin) @ 1000, 800, 600 ml, Dual gold 960 EC (S metolachlor) @ 800, 600, 400, Topmax 96 EC (83% metolachlor+13%pendimethalin) @900, 700, Preact 96 EC (83 S metola+13%pendimethalin)@ 900, 800, Axifin 24 EC (Oxyfluorfen) @ 300, Relax 50 EC (acetochlor) @ 400, 300, Recall 42 EC (pendimethalin plus acetochlor 1000, 800, Metric 450 SC (**Pendimethalin + clomazone**) @ 500, Pert plus (metazachlor) @400 ml/acre and Carbex 75 WDG (linuron) @ 250 200, Sencor 70 WP (metribuzin) @ 800, 100, Isoproturon @ 800 and 500 gram /acre as post emergence. Note: One ridge was left as control along each treatment. The following results were met during the 1st year of study:

Effect of herbicides on the germination / plant population %

Control	**Garlic**	**93**	**Peas**	**95**	**spinach**	**93**	**turnip**	**88**	**carrot**	**88**	**onion**	**75**	**coriander**	**75**	**radish**	**94**	**Fenu**	95
Dual 800	**Garlic**	**90**	**Peas**	**90**	**spinach**	**20**	**turnip**	**20**	**carrot**	**65**	**onion**	**00**	**coriander**	**60**	**radish**	**70**	**Fenu**	00
Dual 600	**Garlic**	**92**	**Peas**	**90**	**spinach**	**45**	**turnip**	**30**	**carrot**	**75**	**onion**	**00**	**coriander**	**65**	**radish**	**70**	**Fenu**	00
Dual 400	**Garlic**	**92**	**Peas**	**90**	**spinach**	**55**	**turnip**	**45**	**carrot**	**80**	**onion**	**10**	**coriander**	**68**	**radish**	**88**	**Fenu**	10
Stomp 1000	**Garlic**	**93**	**Peas**	**93**	**spinach**	**10**	**turnip**	**10**	**carrot**	**80**	**onion**	**10**	**coriander**	**70**	**radish**	**80**	**Fenu**	00
Stomp 800	**Garlic**	**93**	**Peas**	**93**	**spinach**	**30**	**turnip**	**20**	**carrot**	**85**	**onion**	**20**	**coriander**	**72**	**radish**	**90**	**Fenu**	00
Stomp 600	**Garlic**	**93**	**Peas**	**93**	**spinach**	**40**	**turnip**	**35**	**carrot**	**85**	**onion**	**55**	**coriander**	**75**	**radish**	**90**	**Fenu**	00
Preact 900	**Garlic**	**90**	**Peas**	**90**	**spinach**	**20**	**turnip**	**15**	**carrot**	**80**	**onion**	**00**	**coriander**	**65**	**radish**	**85**	**Fenu**	00
Preact 700	**Garlic**	**90**	**Peas**	**90**	**spinach**	**30**	**turnip**	**30**	**carrot**	**85**	**onion**	**10**	**coriander**	**75**	**radish**	**90**	**Fenu**	00
Topmax 900	**Garlic**	**90**	**Peas**	**90**	**spinach**	**20**	**turnip**	**15**	**carrot**	**80**	**onion**	**00**	**coriander**	**65**	**radish**	**85**	**Fenu**	00
Topmax 700	**Garlic**	**90**	**Peas**	**90**	**spinach**	**30**	**turnip**	**30**	**carrot**	**85**	**onion**	**10**	**coriander**	**75**	**radish**	**90**	**Fenu**	00
Relax 500	**Garlic**	**85**	**Peas**	**85**	**spinach**	**10**	**turnip**	**00**	**carrot**	**80**	**onion**	**00**	**coriande**	**45**	**radish**	**85**	**Fenu**	00
Relax 300	**Garlic**	**90**	**Peas**	**90**	**spinach**	**20**	**turnip**	**10**	**carrot**	**85**	**onion**	**00**	**coriande**	**65**	**radish**	**88**	**Fenu**	00
Axifin 300	**Garlic**	**90**	**Peas**	**20**	**spinach**	**00**	**turnip**	**00**	**carrot**	**00**	**onion**	**00**	**coriander**	**00**	**radish**	**00**	**Fenu**	00
Recall 1000	**Garlic**	**90**	**Peas**	**85**	**spinach**	**00**	**turnip**	**00**	**carrot**	**50**	**onion**	**00**	**coriander**	**60**	**radish**	**75**	**Fenu**	00
Recall 800	**Garlic**	**90**	**Peas**	**85**	**spinach**	**00**	**turnip**	**00**	**carrot**	**60**	**onion**	**00**	**coriander**	**65**	**radish**	**80**	**Fenu**	00
Metric 500	**Garlic**	**90**	**Peas**	**70**	**spinach**	**00**	**turnip**	**00**	**carrot**	**60**	**onion**	**00**	**coriander**	**35**	**radish**	**75**	**Fenu**	00
Pert 400	**Garlic**	**90**	**Peas**	**85**	**spinach**	**?**	**turnip**	**?**	**carrot**	**?**	**onion**	**00**	**coriander**	**?**	**radish**	**85**	**Fenu**	60

Garlic:

It is evident from the germination % data that all three doses of pre emergence spray of Dual gold @ 800, 600 and 400 ml, Stomp @ 1000, 800 and 600 ml, two doses each of Topmax and

Preact @ 900, 700 ml /acre, Axifin @ 300, Relax 50 EC @ 400, 300, Recall 42 EC 1000, 800, Metric @ 500 and Pert plus (@400 ml/acre were found equally safe on the germination of garlic. Post emergence application of Axial @ 320 ml was found safe for the control of emerged grassy weeds. However Carbex @ 250 200, Sencor 70 WP (metribuzin) @ 80, 100 gram, Isoproturon @ 800 and 500 gram /acre were not found safe and they affected the growth of garlic. As regards the weed counts, Dual gold @ 800 ml, Stomp @ 1000 ml, Topmax and Preact @ 900 ml, Axifin @ 300 and Metric @ 500 ml/acre gave equally effective weed control.

Onion:

It is evident from the germination counts data that most of the treatments affected the germination of onion. However, Stomp @ 600 ml/acre was found fairly safe on ridge sown onion. As regards the weed control, Dual gold @ 800 ml, Stomp @ 1000 ml, Topmax and Preact @ 900 ml /acre gave equally effective results.

Peas:

All three doses of pre emergence spray of Dual gold @ 800, 600 and 400 ml, Stomp @ 1000, 800 and 600 ml, two doses each of Topmax and Preact @ 900, 700 ml /acre, Recall 42 EC 1000, 800, Metric @ 500 and Pert plus (@400 ml/acre were found equally safe on the germination. However, Axifin @ 300, Relax 50 EC @ 400, 300 ml/acre affected the germination of peas. As regards the weed control Dual gold @ 800 ml, Stomp @ 1000 ml, Topmax and Preact @ 900 ml, Axifin @ 300 and Metric @ 500 ml/acre gave equally effective results.

Radish:

All three doses of pre emergence spray of Dual gold @ 800, 600 and 400 ml, Stomp @ 1000, 800 and 600 ml, two doses each of Topmax and Preact @ 900, 700 ml /acre, Recall 42 EC 1000, 800, Metric @ 500 and Pert plus (@400 ml/acre were found equally safe on the germination of radish. However, Axifin @ 300 lead to no germination, Relax 50 EC @ 400, 300 ml/acre affected the germination. As regards the weed control Dual gold @ 800 ml, Stomp @ 1000 ml, Topmax and Preact @ 900 ml, Axifin @ 300 and Metric @ 500 ml/acre gave equally effective results.

Total Weed Counts/m^2 (It was derived from the sum of individual weed counts/m^2)

Control	**Garlic**	**88**	**Peas**	**75**	**spinach**	**82**	**turnip**	**78**	**carrot**	**77**	**onion**	**66**	**coriander**	**68**	**radish**	**67**	**Fenu**	77
Dual 800	**Garlic**	**10**	**Peas**	**11**	**spinach**	**11**	**turnip**	**09**	**carrot**	**09**	**onion**	**10**	**coriander**	**10**	**radish**	**12**	**Fenu**	11
Dual 600	**Garlic**	**13**	**Peas**	**15**	**spinach**	**13**	**turnip**	**13**	**carrot**	**14**	**onion**	**12**	**coriande**	**14**	**radish**	**15**	**Fenu**	10
Dual 400	**Garlic**	**25**	**Peas**	**30**	**spinach**	**25**	**turnip**	**26**	**carrot**	**21**	**onion**	**27**	**coriande**	**30**	**radish**	**27**	**Fenu**	24
Stomp 1000	**Garlic**	**09**	**Peas**	**10**	**spinach**	**10**	**turnip**	**08**	**carrot**	**09**	**onion**	**11**	**coriander**	**12**	**radish**	**12**	**Fenu**	12
Stomp 800	**Garlic**	**15**	**Peas**	**15**	**spinach**	**14**	**turnip**	**15**	**carrot**	**16**	**onion**	**16**	**coriande**	**16**	**radish**	**15**	**Fenu**	17
Stomp 600	**Garlic**	**29**	**Peas**	**30**	**spinach**	**26**	**turnip**	**28**	**carrot**	**31**	**onion**	**27**	**coriande**	**30**	**radish**	**32**	**Fenu**	28
Preact 900	**Garlic**	**10**	**Peas**	**10**	**spinach**	**12**	**turnip**	**09**	**carrot**	**10**	**onion**	**13**	**coriander**	**12**	**radish**	**13**	**Fenu**	14
Preact 700	**Garlic**	**16**	**Peas**	**15**	**spinach**	**17**	**turnip**	**15**	**carrot**	**14**	**onion**	**16**	**coriande**	**18**	**radish**	**15**	**Fenu**	19
Topmax 900	**Garlic**	**11**	**peas**	**10**	**spinach**	**11**	**turnip**	**09**	**carrot**	**10**	**onion**	**10**	**coriander**	**12**	**radish**	**12**	**Fenu**	12
Topmax 700	**Garlic**	**15**	**peas**	**15**	**spinach**	**17**	**turnip**	**13**	**carrot**	**14**	**onion**	**15**	**coriande**	**17**	**radish**	**15**	**Fenu**	18
Relax 500	**Garlic**	**26**	**peas**	**30**	**spinach**	**28**	**turnip**	**26**	**carrot**	**23**	**onion**	**26**	**coriande**	**30**	**radish**	**27**	**Fenu**	25
Relax 300	**Garlic**	**35**	**peas**	**30**	**spinach**	**33**	**turnip**	**36**	**carrot**	**31**	**onion**	**37**	**coriande**	**30**	**radish**	**37**	**Fenu**	34
Axifin 300	**Garlic**	**05**	**peas**	**06**	**spinach**	**06**	**turnip**	**05**	**carrot**	**06**	**onion**	**07**	**coriande**	**06**	**radish**	**10**	**Fenu**	09
Recall 1000	**Garlic**	**35**	**peas**	**39**	**spinach**	**36**	**turnip**	**36**	**carrot**	**33**	**onion**	**37**	**coriande**	**38**	**radish**	**37**	**Fenu**	32
Recall 800	**Garlic**	**45**	**peas**	**40**	**spinach**	**42**	**turnip**	**41**	**carrot**	**44**	**onion**	**47**	**coriande**	**41**	**radish**	**47**	**Fenu**	44
Metric 500	**Garlic**	**10**	**peas**	**10**	**spinach**	**11**	**turnip**	**09**	**carrot**	**10**	**onion**	**08**	**coriander**	**12**	**radish**	**11**	**Fenu**	09
Pert 400	**Garlic**	**49**	**peas**	**48**	**spinach**	**48**	**turnip**	**52**	**carrot**	**49**	**onion**	**47**	**coriande**	**55**	**radish**	**66**	**Fenu**	55

Turnip: It is evident from the germination data that most of the treatments affected the germination of onion. However, Dual gold @ 400 ml/acre was found fairly (50%) safe on ridge sown turnip and gave satisfactory weed control. As regards the weed control, Dual gold @ 800

ml, Stomp @ 1000 ml, Topmax and Preact @ 900 ml /acre gave equally effective results but these doses showed ill effects on the germination.

Coriander: Dual gold @ 600 and 400 ml, Stomp @ 1000, 800 and 600 ml, two doses each of Topmax and Preact @ 700 ml /acre were found equally safe on the germination. However, the application of Stomp @ 1000 ml/acre had an edge in safety of germination. Axifin @ 300 lead to no germination, Relax 50 EC @ 400, 300 ml/acre also affected the germination. Out of post emergence herbicides Carbex 75 WDG (linuron) @ 200g and Axial @ 320 ml/acre gave effective weed control without harming the crop.

Cauliflower: All three doses of pre emergence spray of Dual gold @ 800, 600 and 400 ml, Stomp @ 1000, 800 and 600 ml, two doses each of Topmax and Preact @ 900, 700 ml /acre and All three doses of pre emergence spray of Dual gold @ 800, 600 and 400 ml, Stomp @ 1000, 800 and 600 ml, two doses each of Topmax and Preact @ 900, 700 ml /acre, Recall 42 EC 1000, 800, Metric @ 500 and Pert plus (@400 ml/acre were found equally safe on the germinationwere found equally safe on the germination of cauliflower. It was further recorded that post emergence application of Pert plus (@400 ml/acre gave effective control of *Trianthama portulacastrum (Itsit)* from cauliflower.

Fenugreek and Spinach: Not a single pre emergence herbicide was found safe on fenugreek and spinach. However, post emergence spray of Axial @ 320 ml/acre was found safe on both the crops. Pre emergence application of Dual gold @ 400 ml/acre was found relatively 50% safe on ridge sown spinach.

Crop safety level % (It was derived from germination counts/m^2)

Control	**Garlic**	**100**	**peas**	**100**	**spinach**	**100**	**turnip**	**100**	**carrot**	**100**	**onion**	**100**	**coriander**	**100**	**radish**	**100**	**Fenu**	**100**
Dual 800	**Garlic**	**80**	**peas**	**75**	**spinach**	**15**	**turnip**	**10**	**carrot**	**75**	**onion**	**00**	**coriander**	**60**	**radish**	**85**	**Fenu**	00
Dual 600	**Garlic**	**90**	**peas**	**85**	**spinach**	**30**	**turnip**	**20**	**carrot**	**85**	**onion**	**15**	**coriander**	**80**	**radish**	**90**	**Fenu**	00
Dual 400	**Garlic**	**95**	**peas**	**95**	**spinach**	**50**	**turnip**	**50**	**carrot**	**95**	**onion**	**30**	**coriander**	**90**	**radish**	**95**	**Fenu**	05
Stomp 1000	**Garlic**	**90**	**peas**	**90**	**spinach**	**10**	**turnip**	**10**	**carrot**	**85**	**onion**	**10**	**coriander**	**90**	**radish**	**80**	**Fenu**	00
Stomp 800	**Garlic**	**95**	**peas**	**95**	**spinach**	**20**	**turnip**	**15**	**carrot**	**95**	**onion**	**20**	**coriander**	**95**	**radish**	**90**	**Fenu**	00
Stomp 600	**Garlic**	**95**	**peas**	**100**	**spinach**	**40**	**turnip**	**30**	**carrot**	**98**	**onion**	**60**	**coriander**	**100**	**radish**	**95**	**Fenu**	10
Preact 900	**Garlic**	**85**	**peas**	**75**	**spinach**	**10**	**turnip**	**15**	**carrot**	**85**	**onion**	**05**	**coriander**	**80**	**radish**	**85**	**Fenu**	00
Preact 700	**Garlic**	**90**	**peas**	**85**	**spinach**	**20**	**turnip**	**30**	**carrot**	**90**	**onion**	**10**	**coriander**	**85**	**radish**	**90**	**Fenu**	00
Topmax 900	**Garlic**	**85**	**peas**	**80**	**spinach**	**15**	**turnip**	**15**	**carrot**	**85**	**onion**	**05**	**coriander**	**80**	**radish**	**85**	**Fenu**	00

Topmax 700	**Garlic**	**90**	**peas**	**90**	**spinach**	**30**	**turnip**	**30**	**carrot**	**90**	**onion**	**10**	**coriander**	**85**	**radish**	**90**	**Fenu**	00
Relax 500	**Garlic**	**80**	**peas**	**75**	**spinach**	**15**	**turnip**	**10**	**carrot**	**75**	**onion**	**00**	**coriander**	**80**	**radish**	**80**	**Fenu**	00
Relax 300	**Garlic**	**85**	**peas**	**85**	**spinach**	**30**	**turnip**	**20**	**carrot**	**85**	**onion**	**05**	**coriander**	**85**	**radish**	**85**	**Fenu**	00
Axifin 300	**Garlic**	**90**	**peas**	**00**	**spinach**	**00**	**turnip**	**00**	**carrot**	**00**	**onion**	**00**	**coriander**	**00**	**radish**	**00**	**Fenu**	00
Recall 1000	**Garlic**	**85**	**peas**	**75**	**spinach**	**10**	**turnip**	**15**	**carrot**	**85**	**onion**	**05**	**coriander**	**80**	**radish**	**85**	**Fenu**	00
Recall 800	**Garlic**	**90**	**peas**	**85**	**spinach**	**20**	**turnip**	**30**	**carrot**	**90**	**onion**	**10**	**coriander**	**85**	**radish**	**90**	**Fenu**	00
Metric 500	**Garlic**	**60**	**peas**	**75**	**spinach**	**00**	**turnip**	**00**	**carrot**	**30**	**onion**	**00**	**coriander**	**70**	**radish**	**70**	**Fenu**	00

TITLE-13: WEED MANAGEMENT IN DRILL SOWN CANOLA

Weeds decrease canola yield very drastically. This trial was sown to investigate the most practicable package of weed management in this crop. Three pre emergence herbicides viz *Stomp 455 g/l CS @* 2500 ml , *Dual gold 960 EC @ 2000 ml* and *Topmax 96 EC @* 2250 ml ha^{-1} were applied as pre emergence and pre plant incorporation (PPI). Three post emergence herbicides viz. *Pert 50 SC @ 800, 1000 ml, G Max lite 15 EC @ 650 ml and Axial 050 EC @ 825 ml ha-1* were also included to cope with dicot weeds especially *Trianthema portulacastrum (Itsit)* and grasses. It was concluded that *Dual gold 960 EC @ 2000 ml* and *Topmax 96 EC @* 2250 were found safer than *Stomp 455 g/l CS @* 2500 ml. The post emergence application of *Pert 50 SC @ 800, 1000 ml, G Max lite 15 EC @ 650 ml and Axial 050 EC @ 825 ml* $ha^{-1}$was also found safe on canola. Statistical analysis and detail of the results during the 1st year of study are as under:

Effect of Herbicides on Weed control and Seed yield of Faisal Canola

#	Treatment	Dose ha^{-1}	Weeds m^{-1}	Control %	Seed yield ha^{-1}
T1	*Stomp 455 g/l CS* Pendimethalin pre emergence	2500 ml	30 e	67	3174 b
T2	*Stomp 455 g/l CS* Pendimethalin PPI	2500 ml	24 f	73	2777 d
T3	*Dual gold 960 EC* S metolachlor pre emergence	2000 ml	18 g	80	3439 a
T4	*Dual gold 960 EC* S metolachlor PPI	2000 ml	10 h	89	3306 b
T5	*Topmax 96 EC* pre emergence Pendi+ metolachlor	2250 ml	13 h	86	3306 b
T6	*Topmax 96 EC*	2250 ml	15 h	84	3306 b

	Pendi+ metolachlor PPI				
T7	*Pert 50 SC* Metazachlor post emergence	800 ml	70 c	*24*	*3041 c*
T8	*Pert 50 SC* Metazachlor post emergence	1000 ml	73 b	*21*	*3174 b*
T9	*G Max lite 15 EC* Quizalofop post emergence	650 ml	78 b	*15*	*3306 b*
T10	*Axial 050 EC* *Penoxaden* post emergence	825 ml	76 b	17	3439 a
T11	*Pert50 SC + G Max lite* Metazachlor+ Quizalofop post	1000 ml + 650 ml	53 d	*42*	*3439 a*
T12	Manual/mechanical control		14 h	*78*	*3571 a*
T13	Control/weedicheck		92 a	-	*2645 d*
CD1			5.5		*263*

Weed control:

It is evident from the data that out of the pre emergence herbicides pre plant incorporated application of *Dual gold* 960 EC @ 2000 ml ha^{-1} gave as the most effective weed control of 89% with only 10 weeds m^{-1}. It was followed by the *Topmax 96 EC* @2250 ml ha^{-1} as pre emergence and pre plant incorporated application with weed control of 86 and 84% having 13 an15 weeds m^{-1}. *Topmax* was not found as safe as that of Dual gold. Not only the weed control of pre emergence and PPI application of Stomp 455 g/l CS was found in effective i.e; 67 and 73% but its ill effect was also recorded on the germination of canola.

As regards the post emergence herbicides, application of *Pert 50 SC (*Metazachlor) @ 1000 $mlha^{-1}$ gave selective control of weeds by 73%. This herbicide was found more effective against *ITSIT (Trianthema portulacastrum).* The grass killer herbicides viz. *G Max lite 15 EC (*Quizalofop) @ 675 ml, *Axial 050 EC (Penoxaden*)@ 825 ml ha^{-1} were found selectively effective against grassy weeds and the combined application of Pert50 SC + G Max lite was also found safe on canola. Dicot weeds were eradicated aster the collection of data from grass killer treatments.

Seed Yield:

As regards the seed yield of canola, highest seed yield of 3571 kg ha^{-1} was recorded in case of hand weeding. It was followed by *Axial 050 EC* @ 825 ml ha^{-1}, *Pert50 SC + G Max lite* @1000 ml+650 ml ha^{-1} andpre plant incorporated application of *Dual gold* 960 EC @ 2000 ml ha^{-1} with 3439kg ha-1 in all cases. However, the seed yield data of these treatments were found at par statistically.

TITLE-14: WEED MANAGEMENT IN GRAM/CHICKPEA

Weeds decrease chickpea yield very drastically. This trial was aimed at to investigate the most practicable package of weed management in chickpea in the irrigated conditions. Three pre emergence herbicides viz *Stomp 455 g/l CS* @3000 ml, *Dual gold 960 EC* @2000 ml, *Topmax 96 EC @ 2250 ml ha*$^{-1}$used as pre emergence and pre plant incorporation (PPI)and two post emergence herbicides *viz. G Max lite 15 EC* @650 ml and *Axial 050 EC* @825 ml ha^{-1} were used. It was concluded that *Stomp 455 g/l CS* @3000 ml gave better and safe weed control and better yield than *Dual gold 960 EC* @2000 ml and *Topmax 96 EC @ 2250 ml*$^{-1}$. Detail of the 1st years study is given as below:

Effect of herbicides on weed control and seed yield of chickpea

#	Treatment	Dose/ha	Weeds m^{-1}	Yield Kg ha^{-1}
T1	*Stomp 455 g/l CS* Pendimethalin pre emergence	3000 ml	08 c	1820 b
T2	*Stomp 455 g/l CS* Pendimethalin PPI	3000 ml	09 c	1950 b
T3	*Dual gold 960 EC* S metolachlor pre emergence	2000 ml	16 b	1725 c
T4	*Dual gold 960 EC* S metolachlor PPI	2000 ml	20 b	1785 c
T5	*Topmax 96 EC* Pendi+ metolachlor pre emergence	2250 ml	09 c	1700 c
T6	*Topmax 96 EC* Pendi+ metolachlor PPI	2250 ml	10 c	1780 c
T7	*G Max lite 15 EC* Quizalofop Post emergence	650 ml	01d	***1570 d***
T8	*Axial 050 EC* Penoxaden Post emergence	825 ml	01 d	1580 d
T9	Manual/mechanical control		01 d	2025 a
T10	Control/weedicheck		144 a	835 e
		CED 1	3.5	145

Weed control: It is evident from the weed counts m^{-1} data that *Stomp 455 g/l CS* @3000 ml and *Topmax 96 EC* @2250 ml ha^{-1} as pre and PPI gave at par weed control i.e;08, 09 and 09, 10 weeds m-1 respectively. However both the herbicides gave weed control significantly better and more safe than *Dual gold 960 EC* @ 2000 ml ha^{-1} as pre emergence and PPI which left 16 and 20 weeds respectively. As regards the post emergence herbicides *viz. G Max lite 15 EC* @650 ml and *Axial 050 EC* @825 ml^{-1} ha both gave equally safe, effective control of grassy weeds especially Avena fatua (Jangli Jai) and Phalaris minor (Dumbi sittee) and left only 01 weed m^{-1}.

Seed Yield: As regards the seed yield of chickpea, highest production of 2025 kg ha^{-1} was recorded in case of hand weeding (thrice). It was followed by the *Stomp 455 g/l CS* @3000 ml and *Topmax 96 EC* @2250 ml ha^{-1} as pre and PPI which yielded 1820 and 1950 kg ha^{-1}

respectively. *Dual gold 960 EC* @ 2000 ml and *Topmax 96 EC* pre emergence and PPI @ 2250 ml ha gave at par yield of 1725, 1785, 1700 and 1780 kg ha^{-1} respectively. The post emergence herbicide viz. *G Max lite 15 EC* @650 ml and *Axial 050 EC* @825 ml ha inspite of good weed control gave poor yield of 1570 and 1580 kg ha^{-1} due to the attack of broad leaved weeds which were removed in the later stages.

TITLE-15: WEED MANAGEMENT IN LENTIL

Weeds decrease lentil yield very drastically. This trial was aimed at to investigate the most practicable package of weed management in lentil in the irrigated conditions. Three pre emergence herbicides viz *Stomp 455 g/l CS* @3000 ml, *Dual gold 960 EC* @2000 ml, *Topmax 96 EC @ 2250 ml* ha^{-1}used as pre emergence and pre plant incorporation (PPI)and two post emergence herbicides *viz. G Max lite 15 EC* @650 ml and *Axial 050 EC* @825 ml ha^{-1} were used. It was concluded that *Stomp 455 g/l CS* @3000 ml gave better and safe weed control and better yield than *Dual gold 960 EC* @2000 ml and *Topmax 96 EC @ 2250* ml^{-1}. Detail of the 1st years study is given as below:

Table: Effect of herbicides on weed control and seed yield of lentils

#	**Treatment**	**Dose/ha**	**Weeds** m^{-1}	**Yield Kg** ha^{-1}
T1	*Stomp 455 g/l CS* Pendimethalin pre emergence	3000 ml	08 c	975 b
T2	*Stomp 455 g/l CS* Pendimethalin PPI	3000 ml	09 c	915 b
T3	*Dual gold 960 EC* S metolachlor pre emergence	2000 ml	16 b	830 c
T4	*Dual gold 960 EC* S metolachlor PPI	2000 ml	20 b	790 c
T5	*Topmax 96 EC* Pendi+ metolachlor pre emergence	2250 ml	09 c	845 c
T6	*Topmax 96 EC* Pendi+ metolachlor PPI	2250 ml	10 c	805 c
T7	*G Max lite 15 EC* Quizalofop Post emergence	650 ml	01d	735 d
T8	*Axial 050 EC* Penoxaden Post emergence	825 ml	01 d	740 d
T9	Manual/mechanical control		01 d	1050 a
T10	Control/weedicheck		144 a	315 e
		CED 1	3.5	105

Weed control:

It is evident from the weed counts m^{-1} data that *Stomp 455 g/l CS* @3000 ml and *Topmax 96 EC* @2250 ml ha^{-1} as pre and PPI gave at par weed control i.e;08, 09 and 09, 10 weeds m-1 respectively. However both the herbicides gave weed control significantly better and more safe

than *Dual gold 960 EC* @ 2000 ml ha^{-1} as pre emergence and PPI which left 16 and 20 weeds respectively. As regards the post emergence herbicides *viz. G Max lite 15 EC* @650 ml and *Axial 050 EC* @825 ml^{-1} ha both gave equally safe, effective control of grassy weeds especially *Avena fatua (Jangli Jai) and Phalaris minor (Dumbi sittee)* and left only 01 weed m^{-1}.

Seed Yield:

As regards the seed yield of lentil, highest production of 1050 kg ha^{-1} was recorded in case of hand weeding (thrice). It was followed by the *Stomp 455 g/l CS* @3000 ml and *Topmax 96 EC* @ 2250 ml ha^{-1} as pre and PPI which yielded 975 and 915 kg ha^{-1} respectively. *Dual gold 960 EC* @ 2000 ml and *Topmax 96 EC* pre emergence and PPI @ 2250 ml ha gave at par yield of 830, 790, 845 and 805 kg ha^{-1} respectively. The post emergence herbicide viz. *G Max lite 15 EC* @650 ml and *Axial 050 EC* @ 825 ml ha inspite of good weed control gave poor yield of 735 and 740 kg ha^{-1} due to the attack of broad leaved weeds which were removed in the later stages.

CEREALS AND PULSES SECTION

TITLE-16: COMPARISON OF DIFFERENT PLANTING METHODS IN TRANSPLANTED FINE RICE

This experiment was conducted to check out the yield response of fine rice to various planting methods. The trial was replicated thrice in RCBD (Randomized Complete Block Design). Nursery was transplanted during last week of June. Fertilizer was applied @ 140: 80: 65 NPK kg ha^{-1}. All P, K and $1/3^{rd}$ N was applied as basal dose while the remaining $2/3^{rd}$ N was applied in 2 splits during July and August. Net plot size was 1 kanal. All other Agronomic practices were kept uniform. Statistically analyzed data is as given below:

No.	**Treatments**	**Super Basmati** **Paddy Yield (kg ha^{-1})**	**Noor Basmati** **Paddy Yield (kg ha^{-1})**
1	Conventional transplanting	4267 C	4644 C
2	Furrow irrigated raised bed transplanting	4622 B	5067 B
3	Ridge transplanting	4267 C	4978 B
4	Furrow transplanting	4111 D	4889 BC
5	Ridge +Furrow transplanting	5000 A	5867 A
LSD at 0.05		126.61	290.04

Results indicated that Ridge +Furrow transplanting of rice resulted in maximum paddy yield 5867 kg ha^{-1} and 5000 kg ha^{-1} in Noor Basmati and Super Basmati respectively while furrow transplanting gave minimum (4111 kg ha^{-1}) yield.

TITLE-17: EFFECT OF INORGANIC, ORGANIC AND BIO-FERTILIZERS ON GROWTH AND YIELD OF RICE

The experiment was laid out in RCBD with three replications. Plot size was kept 5 m ×10 m. Nursery was transplanted during 1^{st} week of July. Fertilizer was provided from synthetic, organic and bio fertilizer sources at different ratios. All agronomic practices were kept uniform. Data on yield & yield components, economic return was also recorded.

No.	Treatment	Paddy Yield (kg ha^{-1})
1	Full dose of synthetic fertilizer	3600 AB
2	25% synthetic fertilizer + 75% FYM	3100 B
3	50% synthetic fertilizer + 50% FYM	4066 A
4	25% synthetic fertilizer + 75% FYM+ B	3066 B
5	50% synthetic fertilizer + 50% FYM+ B	3500 AB
LSD at 0.05		571

Results indicated that the treatment where 50 % synthetic fertilizer + 50 % FYM was applied resulted in maximum 4066.67 kg ha^{-1} paddy yield while minimum 3100 kg ha^{-1} was observed in treatment where 25% synthetic fertilizer + 75% FYM was applied.

TITLE-18: YIELD RESPONSE OF WHEAT TO VARIOUS PLANTING TECHNIQUES:

A trial was conducted to investigate the yield response of wheat to various planting methods. Five treatments Drill sowing, Broadcast, Broadcast augmented with furrows, Bed planting and sowing with multicrop bed planter were kept in randomized complete block design having three replications. Plots size was 5.85 m × 10.0 m. The sowing was done during last week of November. Seed rate of 100 kg ha^{-1} was used. The fertilizer was applied @ 115-85-60 NPK kg ha^{-1}. All P, K and ½ N was applied at the time of seed bed preparation while the remaining ½ N was applied at 1st irrigation. Statistically analyzed data is presented here:

No.	Treatments	Yield (Kg ha^{-1})
1	Drill sowing	2903 BC
2	Broadcast	2833 C
3	Broadcast augmented with furrows	3243 A
4	Sowing With multicrop bed planter	2831 C
5	Bed planting with hand drill	3026 B
LSD at 0.05		151.92

Statistical analysis showed Broadcast augmented with furrows resulted in maximum grain yield of 3243 kg ha^{-1} while sowing with multi crop bed planter resulted in minimum grain yield (2817 kg ha^{-1}).

TITLE-19: EFFECT OF ZINC BIO-FORTIFICATION ON WHEAT YIELD AT VARIOUS GROWTH STAGES

A trial was conducted to investigate the response of zinc application at various growth stages on wheat yield. Six treatments were kept in randomized complete block design having three replications. Sowing was done during last week of November. Seed rate of 100 kg ha^{-1} was used. Fertilizer was applied @ 115-85-60 NPK kg ha^{-1}. All P, K and ½ N was applied at the time of seed bed preparation while remaining ½ N was applied at 1st irrigation. All other agronomic practices were kept uniform except for the treatments. Data regarding analysis of variance is presented here:

No.	**Treatments**	**Yield (Kg ha^{-1})**
1	ZnSO4 Soil Application @25 kg/ha	4111
2	ZnSO4 Soil Application @12.5 kg/ha	4388
3	ZnSO4 0.5% spray at booting stage	4500
4	ZnSO4 0.5% spray at heading stage	4611
5	ZnSO4 0.5% spray at grain filling stage	4277
6	Control	4666
		NS

Statistical analysis has shown non-significant results. However, ZnSO4 0.5% spray at heading stage resulted in (4611 kg ha^{-1}) grain yield followed by (4500 kg ha^{-1}) ZnSO4 0.5% spray at booting stage and minimum grain yield (4111 kg ha^{-1}) was obtained from ZnSO4 Soil Application @25 kg/ha.

TITLE-20: YIELD RESPONSE OF WHEAT TO VARIOUS APPLICATION TIMES OF PHOSPHOROUS

A trial was conducted to investigate the yield response of wheat to various application times of phosphorus. Five treatments were kept in randomized complete block design having three replications. Sowing was done during last week of November. Seed rate of 100 kg ha^{-1} was used. Fertilizer was applied @ 115-85-60 NPK kg ha^{-1}. All P, K and ½ N was applied at the time of seed bed preparation while remaining ½ N was applied at 1st irrigation. Data regarding analysis of variance is presented here:

No.	Treatments	Yield (Kg ha^{-1})
1	All P applied with rauni irrigation	4211 A
2	All P applied at sowing	3845 C
3	All P applied at first irrigation	3300 D
4	½ P applied at rauni irrigation and ½ at sowing	4193 A
5	½ P applied at sowing and ½ at first Irrigation	4034 B
LSD at 0.05		131.35

Results indicated that the maximum grain yield (4211 kg ha^{-1}) was obtained from treatment where all P was applied with rauni irrigation which is also at par with treatment where ½ P was applied at rauni irrigation and ½ at sowing which resulted in 4193 kg ha^{-1} grain yield. Minimum grain yield (3300 kg ha^{-1}) was observed when all P was applied at first irrigation.

TITLE-21: PERFORMANCE OF LENTIL WITH GARLIC INTERCROPPING

The trial was laid out in RCBD with three replications. Plot size was 1.8 m x 5.0 m. Sowing was done in the last fortnight of October. Lentil was sown @ 20 kg ha^{-1} and garlic was sown @ 800kg ha^{-1}. Seed rate of intercrop was adjusted according to the number of rows per plot. The fertilizer was applied @ 120-90-50 NPK kg ha^{-1}. All P, K and1/3 of N was applied as basal dose. While remaining N was supplied in two splits. All other agronomic practices were kept uniform. Data is given below:

Economic Analysis									
No.	**Treatments**	**Yield of main crop (kg ha^{-1})**	**Intercrop yield (kg ha^{-1})**	**Main Crop Income (Rs. ha^{-1})**	**Intercrop income (Rs. ha^{-1})**	**Total income (Rs. ha^{-1})**	**Total Cost (Rs. ha^{-1})**	**Net Return (Rs. ha^{-1})**	**BCR**
1	Lentil	1432	0	114560	0	114560	70000	44560	1.64
2	Garlic Alone	0	3450.25	0	345025	345025	281300	63725	1.23
3	Lentil 2 Rows on top of bed + Garlic 1 row on each side of bed	1106	1909.5	88480	190950	279430	180000	99430	1.55

4	Lentil 2 Rows on top of bed + Garlic 2 row on each side of bed	980.8	2517.25	78464	251725	330189	180000	150189	1.83

Lentil 2 Rows on top of bed + Garlic 2 row on each side of bed resulted in maximum net economic return with BCR of 1.83.

TITLE-22: PERFORMANCE OF CHICKPEA WITH GARLIC INTERCROPPING

The trial was laid in RCBD with three replications. Plot size was 2.4 m x 5.0 m and sowing was done in the last fortnight of October. Chickpea was sown @ 75 kg ha^{-1} and garlic was sown @ 800 kg ha^{-1}. Seed rate of intercrop was adjusted according to the number of rows per plot. The fertilizer will be applied @ 120-90-50 NPK kg ha^{-1}. All P, K and1/3 of N was applied as basal dose. While remaining N was supplied in two splits. All other agronomic practices were kept uniform. Data is given below:

Results revealed that the maximum benefit cost ratio (1.58) was realized when chickpea was

Economic Analysis									
No.	**Treatments**	**Yield of main crop (kg ha^{-1})**	**Intercrop yield (kg ha^{-1})**	**Main Crop Income (Rs. ha^{-1})**	**Intercrop income (Rs. ha^{-1})**	**Total income (Rs. ha^{-1})**	**Total Cost (Rs. ha^{-1})**	**Net Return (Rs. ha^{-1})**	**BCR**
1	Chickpea alone	1158	0	86850	0	86850	55000	31850	1.58
2	Garlic alone	0	3034.5	0	303450	303450	281300	22150	1.08
3	Chickpea 2 row on top at + garlic one row on each side of the 120 cm apart beds	1156	1310	86700	131000	217700	165000	52700	1.32
4	Chickpea 2 row on top at + 2 rows at RxR 10 cm on each side of the 120 cm apart beds	1001	1419.25	75075	141925	217000	165000	52000	1.32

sown alone.

TITLE-23: COMPARISON OF DIFFERENT PLANTING METHODS IN MASHBEAN

This experiment was conducted to check out the yield response of mashbean to various planting methods. The trial was laid out in RCBD (Randomized Complete Block Design), replicated thrice. Sowing was done during 1st week of May. The crop was fertilized @ 23: 57: 30 NPK kg ha^{-1}. All P and K and half of N were applied at sowing and the remaining half of N was applied at first irrigation. All the Agronomic practices were kept uniform. Statistically analysed data is as given below:

No.	Treatments	Yield (kg ha^{-1})
1	Line Sowing	830 C
2	Broadcast	817 C
3	Broadcast following with deep cultivation	910 BC
4	Broadcast augmented with furrows	1057 AB
5	Furrow irrigated raised beds	1180 A
	LSD at 0.05	163.5

Furrow irrigated raised bed resulted in maximum (1180 kg ha^{-1}) grain yield while minimum yield (817 kg ha^{-1})was obtained from broadcast method.

TITLE-24: YIELD RESPONSE OF LENTIL TO VARIOUS PLANTING TECHNIQUES

This experiment was conducted to check the yield response of lentil to various planting methods. The trial was laid out in RCBD (Randomized Complete Block Design), replicated thrice. The crop was fertilized @ 23: 57: 30 NPK kg ha^{-1}. Whole of the P and K and half of N was applied at sowing and the remaining half of the N was applied at first irrigation. All other Agronomic practices were kept uniform. Statistically analyzed data is as given below:

No.	Treatments	Yield (kg ha^{-1})
1	Zero tillage	746 B
2	Broadcast	750 B
3	Bed sowing	810 B
4	Broadcast augmented with furrows	936 A
5	Drill sowing	823 AB
	LSD at 0.05	115.6

Maximum grain yield (936 kg ha^{-1}) was observed in broadcast augmented with furrow followed by drill sowing (823 kg ha^{-1}) and minimum grain yield (746 kg ha^{-1}) was observed in zero tillage method.

TITLE-25: Impact of Sugarcane Pressmud on growth and yield of lentil

This experiment was conducted to check the yield response of lentil to various levels of pressmud application i.e. 5 tons ha^{-1}, 10 tons ha^{-1}, 15 tons ha^{-1}, 20 tons ha^{-1} and control. The trial was laid out in Randomized Complete Block Design having three replications. Sowing was done during 1st week of November. All other Agronomic practices were kept uniform. Statistically analyzed data is as given below:

No.	Treatments	Yield (kg ha^{-1})
1	Press mud 5 tons ha^{-1}	1022
2	Press mud 10 tons ha^{-1}	1288
3	Press mud 15 tons ha^{-1}	1200
4	Press mud 20 tons ha^{-1}	955
5	Conventional sowing	1133
		NS

Statistical analysis has shown non-significant results. However, press mud application at 10 tons ha^{-1} resulted in maximum 1288 kg ha^{-1} yield and minimum yield 955 kg ha^{-1} was observed in press mud application at 20 tons ha^{-1}.

TITLE-26: EFFECT OF ORGANIC AMENDMENT AND PHOSPHORUS SOLUBILIZING BACTERIA ON GROWTH AND YIELD OF MUNGBEAN

The experiment was laid out in RCBD with three replications. The plot size was 5m × 10m. Sowing was done during last week of May. The crop was fertilized @ 23: 57: 30 NPK kg ha^{-1}. Whole of the P and K and half of N was applied at sowing and the remaining half of the N was applied at first irrigation. Except treatments all agronomic practices were kept uniform. Data is presented here:

Sr. No.	Treatment	Grain Yield (kg ha^{-1})
1	Mungbean Conventional method	930 BC
2	Mungbean + FYM	907 C
3	Mungbean+ Press Mud	980 BC
4	Mungbean + FYM + PSB	1223 A
5	Mungbean + Press Mud + PSB	1070 B
	LSD at 0.05	144.95

Maximum seed yield 1223 kg ha^{-1} was obtained from treatment where FYM and PSB was applied while minimum yield 907 kg ha^{-1} was observed in FYM application.

TITLE-27: EFFECT OF ORGANIC AMENDMENT AND PHOSPHORUS SOLUBILIZING BACTERIA ON GROWTH AND YIELD OF MASHBEAN

The experiment was laid out in RCBD with three replications. The plot size was 5m × 10m. Crop was sown during last week of May. The crop was fertilized @ 23: 57: 30 NPK kg ha^{-1}. Whole of the P and K and half of N was applied at sowing and the remaining half of the N was applied at first irrigation. Except treatments all agronomic practices were kept uniform. Data is presented here:

No.	Treatment	Grain Yield (kg ha^{-1})
1	Mashbean Conventional method	785
2	Mashbean + FYM	767
3	Mashbean + Press Mud	840
4	Mashbean + FYM + PSB	971
5	Mashbean + Press Mud + PSB	880
		N.S

Statistical analysis has shown non-significant results. However, Maximum seed yield 971 kg ha^{-1} was obtained from treatment where FYM and PSB was applied while minimum yield 767 kg ha^{-1} was observed in FYM application.

TITLE-28: INTERCROPPING OF MUNGBEAN AND MASHBEAN IN MAIZE

The experiment was laid out in RCBD with three replications. The plot size was 10 m × 15 m. The fertilizer was applied @ 100-52-50 NPK kg/ha. On the other hand recommended dose of NPK in all intercrops was used at their proper time. All agronomic practices were kept uniform. Data on yield & yield components was recorded and economic return was calculated.

Treatment	Maize Grain Yield (kg ha^{-1})	Mung/Mash Grain Yield (kg ha^{-1})	Net Return (Rs. ha^{-1})
Maize alone	4778	0	21636
Maize + Mung bean (1 Row)	4193	459	34407
Maize + Mung bean (2 Row)	3904	593	41007
Maize + Mash bean (1 Row)	4141	437	31207
Maize + Mash bean (2 Row)	3956	504	33651

Maximum net economic return of 41007 Rs. was obtained from Maize + Mung bean (2 Row) intercropping.

TITLE-29: MICRO YIELD TRIAL OF DRY PEAS

Twelve advanced lines of drypeas were evaluated for their yield performance. Sowing was done during 1st week of November.

Genotype	**Yield (kg ha^{-1})**
T_1= DP-09-08	2013
T_2= DP-09-22	2291
T_3= DP-01-12	2708
T_4= DP-01-13	3125
T_5= DP-01-14	2638
T_6= DP-06-14	972
T_7= DP=08-14	1180
T_8= DP-09-14	1381
T_9= DP-11-14	1590
T_{10}= DP-12-14	3125
T_{11}= NO.267 (C)	2222
T_{12}= PF-400 (C)	1458

Out of twelve advanced lines of drypeas, DP-01-13 and DP-12-14 excelled rest of the lines by producing the seed yield of 3125 kg ha^{-1}. The lowest seed yield (972 kg ha^{-1}) was received from the plots of DP-06-14.

TITLE-30: VARIETAL TRIAL OF CHICKPEA

Varieties	**Yield (Kg ha^{-1})**
Bittal-2016	184.8
BK 2011	81.1
CH 16/06	213.2
CH 24/07	292.2
104/06	189.3

Five chickpea advanced lines including two checks (Bittal 2016, BK 2011, CH 16/06, CH 24/07 and 104/06. CH 24/07) were compared for their yield performance. The advanced line CH 24/07 outyielded rest of the advanced lines/checks by producing seed yield of 2800 kg ha^{-1}.The advanced line 104/06 produced the least seed yield of 400 kg ha^{-1}. The checks BK-2011 and Bittal-2016 produced 2400 and 2480 kg seed yield per hectare, respectively.

FIBER CROPS SECTION

TITLE-31: PROVINCIAL COTTON CO-ORDINATED TRIAL (PCCT)

This set of trial features permanently in annual program of research with an aim to evaluate yield performance of candidate strains/lines for variety approval. The genotypes were provided by Cotton Research Institute, Faisalabad. Entries were sown in RCBD with three replication having a net plot size of 3 m × 7.5 m. Row × row and plant × plant distance was maintained by 75 cm and 30 cm, respectively. A uniform N-P-K dose of 200-115-95 kg ha^{-1} was applied during whole growth period.

In PCCT-1 (Bt.) 40 genotypes (coded entries) were evaluated for seed cotton yield. Genotype PC-30 gave maximum seed cotton yield of 2677.5 kg ha^{-1} which was also statistically similar with PC-15 with seed cotton yield of 2372.6kg ha^{-1}. However lowest seed cotton yield was recorded from PC-34 with seed cotton yield of 1303.3 kg ha^{-1}. Perusal of the table will provide a further insight into the results.

In PCCT-II (Non-Bt.) 4 genotypes were evaluated for seed cotton yield. The statistical analysis shows that there was no significant difference among the four genotypes.

Seed cotton yield (PCCT- I Bt.) during the year 2017

Coded entry	Seed cotton yield (kg ha^{-1})	Coded entry	Seed cotton yield (kg ha^{-1})
PC-1	1326.6 jklmn	PC-21	1646.0 fghijk
PC-2	1693.5 efghij	PC-22	1433.4 ijklmn
PC-3	2362.7 ab	PC-23	1350.0 jklmn
PC-4	2123.2 bcd	PC-24	1907.0 defg
PC-5	1464.8 ijklmn	PC-25	1944.7 cdefg
PC-6	1184.9 mn	PC-26	1565.2 ghijklm
PC-7	1620.0 fghijkl	PC-27	2081.9 bcde
PC-8	1809.2 defghi	PC-28	1306.9 jklmn
PC-9	1891.7 defgh	PC-29	1916.0 cdefg
PC-10	1560.8 ghijklm	PC-30	2677.5 a
PC-11	1249.5 klmn	PC-31	1228.0 lmn
PC-12	1794.9 defghi	PC-32	1483.6 hijklmn
PC-13	1843.3 defghi	PC-33	1573.3 ghijklm
PC-14	1491.7 hijklmn	PC-34	1303.3 jklmn

PC-15	2372.6 ab	PC-35	1573.3 ghijklm
PC-16	1988.6 bcdef	PC-36	1365.2 jklmn
PC-17	1783.2 defghi	PC-37	1288.1 jklmn
PC-18	2024.5 bcdef	PC-38	1346.4 jklmn
PC-19	1553.6 ghijklm	PC-39	1140.1 n
PC-20	1559.0 ghijklm	PC-40	2321.4 abc
$LSD_{0.05}$: 411.33			

Seed cotton yield (PCCT-II Non Bt.) during the year 2017

Coded Entry	Yield (kg ha^{-1})	Coded Entry	Yield (kg ha^{-1})
V-1	1309.6	V-3	1422.6
V-2	1061.2	V-4	1402.9
$LSD_{0.05}$= NS			

TITLE-32: EVALUATION OF RESOURCE CONSERVATION PRACTICES IN COTTON-WHEAT CROPPING SYSTEM

This experiment was planned to assess the benefits of low/no tillage under different sowing methods in the cotton-wheat cropping system. Treatments consists of three tillage systems viz. zero tillage, minimum tillage (3 ploughing + 2 planking) and conventional tillage (5 ploughing + 4 planking) and three cotton sowing methods viz. bed sowing, ridge sowing and flat sowing. The trial was laid out in RCBD with split block arrangements having fourreplications. Plots size was 4.5 m × 9.0 m with 75 cm row spacing and 30 cm plant spacing. NPK @ 200-115-95 kg $ha^{-1}$was applied to cotton during the whole season. Results reveals that higher seed cotton yield (1806 kg ha^{-1}) was obtained from bed planted cotton while yields from flat planting and ridge sowing ranked 2nd and 3rd. It is also evident from the statistical analysis that higher seed cotton yield was obtained from conventional tillage system while both minimum and zero tillage were statistically at par with each other.

Effect of sowing methods and tillage on Seed Cotton Yield (kg ha^{-1})

	Conventional tillage	Minimum tillage	Zero tillage	Mean
Bed planting	1999 a	1727 d	1692 de	1806 a
Flat planting	1887 b	1679 de	1689 de	1752 b
Ridge Planting	1799 c	1654 e	1641 e	1698 c
Mean	1895 a	1687 b	1674 b	
$LSD_{0.05}$ Tillage = 32.76 Sowing methods = 32.76 Sowing methods × tillage = 56.74				

TITLE-33: MINIMIZING SQUARE/FLOWER SHEDDING IN BT. COTTON WITH NUTRIENT MANAGEMENT

Experiment was conducted to assess the effect of Boron and potassium fertilizer on crop productivity and flower retention in cotton. The objective was to reduce square/flower shedding in cotton by soil application of potassium and boron. Treatments consists of three levels of boron (1.0, 1.5, 2.0 kg ha^{-1}) and two levels of potassium fertilizer (95, 110kg ha^{-1}). The trial was laid out in RCBD having three replications. Plots size was3.0 m × 7.5 mwith 75 cm row spacing and 30 cm plant spacing. NPK @ 200-115-95 kg $ha^{-1}$was applied to cotton. All P_2O_5, K and 1/3rd N was applied at sowing and remaining N at squaring and flowering stages in two equal splits. Results revealed that maximum seed cotton yield (1868 kg ha^{-1}) was obtained when 110 kg K_2O ha^{-1} was applied with 1.5 kg B ha^{-1} which was at par (1701 kg ha^{-1}) with 110 kg K_2O ha^{-1} along 1.0 kg B ha^{-1}. However maximum boll retaining percentage (76%) was observed when 110 kg K_2O ha^{-1} was applied with 1.5 kg B ha^{-1} which was at par (76%) with 110 kg K_2O ha^{-1} along 2.0kgBha^{-1}.

Effect of Potash & Boron on Seed Cotton Yield (kg ha^{-1})

Treatments B (kg ha^{-1})	K_2O (kg ha^{-1})		Mean
	95	110	
1.0	1351 c	1701 ab	1526
1.5	1598 b	1868 a	1733
2.0	1574 b	1605 b	1590
Mean	1508	1725	
$LSD_{0.05}$: = 190.92			

Effect of Potash & Boron on Boll Retaining Percentage

	Retaining %		
Treatments	**95**	**110**	**Mean**
1.0	66 c	72 ab	69
1.5	69 bc	76 a	72
2.0	71 b	76 a	74
Mean	69	75	
$LSD_{0.05}$: = 4.19			

TITLE-34: EVALUATION OF RESOURCE CONSERVATION PRACTICES IN JUTE-WHEAT CROPPING SYSTEM

Zero tillage practice was evaluated in jute-wheat cropping system for both *C. Olitorious*and*C. Capsularis*species of jute against conventional practice. The trial was laid out in RCBD factorial having four replications. Plots size was 1.5 m × 7.0 m with 30 cm row spacing and 10cm plant spacing. Results suggest that significantly taller jute plants (3.76 m) and higher diameter (2.00 cm) were recorded by conventional method of sowing against zero tillage which recorded 2.82 m tall plant and 1.93 cm diameter.

Effect of tillage system on plant height (m) of jutecultivars

Varieties	**Tillage**		
	Conventional tillage	**Zero tillage**	**Mean**
C. capsularis	**2.8575 c**	**2.7750 c**	**2.8162 b**
C. olitorious	**3.9175 a**	**3.6050 b**	**3.7612 a**
Means	**3.3875 a**	**3.1900 b**	
$LSD_{0.05}$ Tillage = 0.0975 Varieties = 0.0975 Varieties × tillage = 0.1379			

Varieties	**Tillage**		
	Conventional tillage	**Zero tillage**	**Mean**
C. capsularis	**2.0250 ab**	**1.8250 c**	**1.9250 a**
C. olitorious	**2.1200 a**	**1.8875 bc**	**2.0038 a**
Means	**2.0725 a**	**1.8563 b**	
LSD0.05 Tillage = 0.1278 Varieties = 0.1278 Varieties × tillage = 0.1808			

TITLE-35: NUTRIENT MANAGEMENT FOR HIGHER FIBER YIELD OF JUTE

The objective of this study was to find out the appropriate nitrogen and phosphorus doses for jute to get higher fiber yield. For this purpose three levels of nitrogen (45, 60, 75 kg ha^{-1}) with three levels of phosphorus (20, 30, 40 kg ha^{-1}) were evaluated. Treatments were laid out in RCBD with three replication with net plot size of 1.8 m × 7.0 m. sowing was done on 3rd week of May. Row to row and plant to plant distance was maintained to be 30 cm and 10 cm, respectively. Perusal of table suggest that interactive effect of N × P was not significant. However both N and P effect the jute fiber yield significantly. Jute fiber yield increased as fertilizer level increased and significantly higher yield was obtained at 40 kg ha^{-1} P and 75 kg ha^{-1} N which was also similar to the 30 kg ha^{-1} P and 60 kg ha^{-1} N, respectively.

Jute Fiber yield (kg ha^{-1})

Treatments	**20 kg P_2O_5 ha^{-1}**	**30 kg P_2O_5 ha^{-1}**	**40 kg P_2O_5 ha^{-1}**	**Mean**
45 kg N ha^{-1}	2215	2510	2717	2481 b
60 kg N ha^{-1}	2930	3418	3395	3248 a
75 kg N ha^{-1}	3362	3408	3517	3429 a
Mean	2836 b	3112 ab	3210 a	
LSD0.05= Nitrogen=299.89 P2O5=299.89 Nitrogen × P2O5 = NS				

TITLE-36: MAINTENANCE AND EVALUATIONOF JUTE GERMPLASM

The objective was characterization of jute crop for desired morpho-agronomic traits to select breeding materials for further crop improvement and to maintain the genetic purity. Nineteen jute lines were sown in progeny to row trial. Plots size was 0.9 m × 5.0 m with 30 cm row spacing and 10 cm plant spacing. Nitrogen and Phosphorus was applied @ 60 and 30 kg ha^{-1}. All phosphorus was applied as basal dose while nitrogen was applied in two equal splits at sowing and 30 days after sowing. Results suggest that line No. 3 gave the more fiber yield and taller plants. Similarly lines No. 10, 9 and 12 are the potential breeding material for further breeding program. Perusal of the table gives further insight about the performance of jute germplasm at Faisalabad conditions.

Average Plant height (m), stem girth (cm) and fiber yield (g) of nineteen jute lines

Line #	Plant Height(m)	Stem Diameter(cm)	Fiber Yield (g)
1	3.51	2.12	8.00
2	3.53	2.36	8.00
3	4.30	1.80	22.80
4	4.28	2.30	18.40
5	4.04	1.94	16.80
6	4.14	1.78	14.80
7	4.18	2.02	15.20
8	4.28	2.56	16.48
9	4.20	1.80	20.70
10	4.38	2.02	21.60
11	4.06	1.94	18.40
12	4.16	2.20	20.40
13	3.82	2.18	17.60
14	3.90	2.30	17.04
15	4.16	2.24	19.30
16	4.06	2.44	18.08
17	4.06	2.04	18.40
18	3.72	1.66	16.14
19	3.80	1.60	17.02

TITLE-37: STUDY OF FILIAL (F_1) GENERATION OF JUTE (*C. olitorius*)

This study as a component of jute variety development program with the objective to select desirable recombinants for the development of high yielding varieties. The trial was carried out in progeny (cross) to row trial. Plots size was 0.9 m × 3.0 m with 30 cm row spacing and 10 cm plant spacing. Nitrogen and Phosphorus were applied @ 60 and 30 kg ha^{-1}. All phosphorus was applied as basal dose while nitrogen was applied in two equal splits at sowing and 30 days after sowing. A total of 8 entries in F_3 and 3 entries in F_4 were raised. Resultantly, the seed of selected plants from 8 entries in F_3 and 3 entries in F_4 were harvested and bulked.

TITLE-38: INTRODUCTION AND MAINTENANCE OF SISAL GERMPLASM

The objective was acclimatization of sisal germplasm for fiber as well as hedge. Five types of sisal germplasm were maintained in blocks with row to row and plant to plant spacing 1.8m.

TITLE-39: ESTABLISHMENT OF SISAL (*Agave sisalana*) NURSERY

The objective of this study was to develop and maintain a nursery of sisal through bulbils and suckers. Nursery was maintained after transplanting of suckers and bulbils of indigenous sisal (*Agave sisalana*).

TITLE-40: IMPACT OF ORGANIC AND BIOFERTILIZER ON MASH BEAN PRODUCTION

The experiment was conducted tofind out the most suitable combination of organic fertilizers for higher grain production and improving soil fertility. The treatments consist of (**T_1**:No manure**T_2**: Compost @ 5 t**T_3**:Farm yard manure @ 5 t**T_4**:Co – inoculation (Rhizobium + PSB)**T_5**: Compost @ 2.5 t + Farm yard manure @ 2.5 t**T_6** :Compost @ 2.5 t + Co – inoculation**T_7**:Farm yard manure @ 2.5 t + Co – inoculation**T_8**:Compost @ 2.5 t + FYM @ 2.5 t + Co – inoculation). The trial was laid out in RCBD factorial having three replications. Plots size was 3.0 m × 9.0 m with 30 cm row spacing and 10cm plant spacing. All organic manures were applied two weeks before sowing of crop.The results revealed that maximum grain yield (760.47 kg ha^{-1}) was obtained with **T8** (Compost @ 2.5 t ha^{-1} + FYM @ 2.5 t ha^{-1} + Co-inoculation) whileminimum grain yield (230.83 kg ha^{-1}) was obtained where no manure was applied.

Treatment		**Yield (kg/ha)**
T_1	No manure	230.83 f
T_2	Compost @ 5 t ha^{-1}	317.30 de
T_3	Farm yard manure @ 5 t ha^{-1}	455.53 c
T_4	Co-inoculation (Rhizobium + Phosphorus solubilizing bacteria)	276.53 ef
T_5	Compost @ 2.5 t ha^{-1} + Farm yard manure @ 2.5 t ha^{-1}	665.47 b
T_6	Compost @ 2.5 t ha^{-1} + Co-inoculation	641.97 b
T_7	Farm yard manure @ 2.5 t ha^{-1} + Co-inoculation	366.63 d
T_8	Compost @ 2.5 t ha^{-1} + FYM @ 2.5 t ha^{-1} + Co-inoculation	760.47 a

Impact of organic manures on mash bean yield

Treatment		**Yield (kg/ha)**
T_1	No manure	230.83 f
T_2	Compost @ 5 t ha^{-1}	317.30 de
T_3	Farm yard manure @ 5 t ha^{-1}	455.53 c

T_4	Co-inoculation (Rhizobium + Phosphorus solubilizing bacteria)	276.53 ef
T_5	Compost @ 2.5 t ha^{-1} + Farm yard manure @ 2.5 t ha^{-1}	665.47 b
T_6	Compost @ 2.5 t ha^{-1} + Co-inoculation	641.97 b
T_7	Farm yard manure @ 2.5 t ha^{-1} + Co-inoculation	366.63 d
T_8	Compost @ 2.5 t ha^{-1} + FYM @ 2.5 t ha^{-1} + Co-inoculation	760.47 a
$LSD_{0.05}$: 83.18		

TITLE-41: EFFECT OF ROCK PHOSPHATE IN COMBINATION WITH NATURAL MANURES ON MUNG BEAN PRODUCTION

The experiment was conducted tofind out the most suitable combination of organic fertilizers for higher grain production and improving soil fertility. The treatments consist of (**T_1**:No manure **T_2**: Rock phosphate @ 0.25 t ha^{-1} **T_3**: Rock phosphate @ 0.25 t ha^{-1} + FYM @ 2.5 t ha^{-1}**T_4**: Rock phosphate @ 0.25 t ha^{-1} + Compost @ 2.5 t ha^{-1}**T_5**: Rock phosphate @ 0.25 t ha^{-1} + Press mud @ 1.0 t ha^{-1}**T_6**: Rock phosphate @ 0.25 t ha^{-1} + Poultry manure @ 1.0 t ha^{-1}**T_7**:Rock phosphate @ 0.25 t ha^{-1} + Vermicompost @ 0.5 t ha^{-1}). The trial was laid out in RCBD factorial having three replications. Plots size was 3.0 m × 9.0 m with 30 cm row spacing and 10cm plant spacing. The organic amendments were applied two weeks before sowing of crop. The results revealed that maximum grain yield (734.53 kg ha^{-1}) was obtained with **T_3** (Rock phosphate @ 0.25 t ha-1 + FYM @ 2.5 t ha^{-1}) which is also at par (690.10kg ha^{-1}) with **T_4** (Rock phosphate @ 0.25 t ha-1 + Compost @ 2.5 t ha^{-1}) while minimum grain yield (304.93 kg ha^{-1}) was obtained where no manure was applied.

Impact of rock phosphate and organic manures on mung bean yield

Treatment		**Yield (kg/ha)**
T_1	No manure	304.93 e
T_2	Rock phosphate @ 0.25 t ha^{-1}	366.17 de
T_3	Rock phosphate @ 0.25 t ha^{-1} + FYM @ 2.5 t ha^{-1}	734.53 a
T_4	Rock phosphate @ 0.25 t ha^{-1} + Compost @ 2.5 t ha^{-}	690.10 ab
T_5	Rock phosphate @ 0.25 t ha^{-1} + Press mud @ 1.0 t ha^{-1}	406.17 d
T_6	Rock phosphate @ 0.25 t ha^{-1} + Poultry manure @ 1.0 t ha^{-1}	623.43 b
T_7	Rock phosphate @ 0.25 t ha^{-1} + Vermicompost @ 0.5 t ha^{-1}	512.33 c
$LSD_{0.05}$: 74.10		

TITLE-42: INFLUENCE OF DIFFERENT ORGANIC SOURCES AND THEIR COMBINATIONS ON YIELD AND YIELD COMPONENTS OF WHEAT (*TRITICUM AESTIVUM)*

Treatments	**Yield (kg ha^{-1})**
Control (no manure)	2658.8c
Press mud @ 10 t ha^{-1}	3825.1ab
Vermicompost @ 10 t ha^{-1}	4477.5a
Farm yard manure @ 10 t ha^{-1}	4223.8a
Press mud @ 5 t ha^{-1} + Vermicompost @ 5 t ha^{-1}	4032.7ab
Press mud @ 5 t ha^{-1} + Farm yard manure @ 5 t ha^{-1}	3377.0b
Press mud @ 3.3 t ha^{-1} + Vermicompost @ 3.3 t ha^{-1} + Farm yard manure @ 3.3 t ha^{-1}	3416.6b
LSD $_{0.05}$ = 708.19	

The experiment was conducted to quantify the influence of organic sources in different combinations on wheat productivity during Rabi season 2017-18. The Randomized Complete Block Design with three replications having net plot size 6.0 m × 1.5 m was used. Wheat variety Galaxy-13 was sown on 24-11-2017. Treatments were; T_1= Control (no manure), T_2= Press mud @ 10 t ha^{-1}, T_3= Vermicompost @ 10 t ha^{-1}, T_4= Farm yard manure @ 10 t ha^{-1}, T_5= Press mud @ 5 t ha^{-1}+Vermicompost @ 5 t ha^{-1}, T_6= Press mud @ 5 t ha^{-1}+Farm yard manure @ 5 t ha^{-1}, T_7= Press mud @ 3.3 t ha^{-1}+Vermicompost @ 3.3 t ha^{-1} +Farm yard manure @ 3.3 t ha^{-1}. It was observed that vermicompost application gave maximum yield (4477.5 kg ha^{-1}) which was statistically at par with farm yard manure (4223.8 kg ha^{-1}) application, press mud + vermicompost (4032.7 kg ha^{-1}) application and press mud (3825.1 kg ha^{-1}) application, whereas minimum yield (2658.8 kg ha^{-1}) was found where no manure was applied.

Impact of different organic manures on wheat yield

VERMICULTURE

The work on vermiculture was started with the direction of Worthy Director Agronomy at Fiber Crops Section. The director provided a collection of 150 worms named *Eiseniafoetida*(red wiggler) for this purpose. The rearing of earthworms for the production of vermicompost in opaque plastic bin. Some holes were made in the bin for aeration. The materials like coconut fiber, compost, newspaper and egg shells were placed as bedding. The worms were placed in plastic bin at 40-60% moisture. The various food stuff such as fruits and vegetables waste, coffee, tea bags, leaf compost and soil is being added at weekly interval in the bin.

The Worms lay lemon-shaped with match head size eggs after 50 days of rearing. They are shiny in appearance, and are light brown in color. After 15 days of hatching eggs, baby worms are produced. Now at this stage we have parent worms, eggs and baby worms all are present in bin. After 3 months we will harvest the compost and shift the parent worms in a new bin with fresh

bedding layers. The eggs and baby worms have been shifted into 2 or 3 new bins for rearing and hatching.

One pit having 13 feet length, 6 feet width and 2 feet depth is formed in the shade of tree for the rearing of local earthworms at Research Area of Fiber Crops Section. The remaining three pits having dimension of 2 feet width, 5 feet length and 1.5 feet depth were formed under the shed for the production of vermicompost by using red wiggler worms and different substrate.

The progress in brief is as under:

- The rearing of earth worms and harvesting of vermicompost from local earthworms and red wiggler is going on.
- Production of baby worms is in progress
- Formation of pit for harvesting of Vermicompost.
- Production of 100 kg vermicompost
- Thirty five kg vermicompost has been used in organic farming trials.

VEGETABLE & OILSEEDS SECTION

TITLE-43: BIO-FORTIFICATION OF CUCUMBER WITH ZINC BY SOIL & FOLIAR APPLICATION OF ($Zn SO_4$)

The experiment was conducted to find out the optimum levels of zinc for soil and foliar application to enhance the nutritional value of cucumber by increasing the availability of Zn in cucumber. The experiment was laid out in RCBD with three replications having a plot size of 5.0 m × 7.0 m. Row and plant spacing were maintained as 250 cm and 50 cm, respectively. Five treatments comprising of control and three treatments of soil application of Zn $SO_4$10,20,30 kg ha^{-1} along with four foliar application 45,55,65,75 DAS and foliar applications 45,55,65,75 DAS was also used as treatment.

Fruit yield and Zn uptake as affected by different doses of ZN So_4

Treatments	Dose (Zn SO4) kg ha^{-1}	Yield (kg ha^{-1})	Zn uptake (ppm)
T_1	Control	15099 c	22 d
T_2	10 + 0.1% spray (45,55,65,75 DAS)	16346 b	39 c
T_3	20 + 0.1% spray (45,55,65,75 DAS)	16696 ab	53 b
T_4	30 + 0.1% spray (45,55,65,75 DAS)	17308 a	64 a
T_5	0.1% spray (45,55,65,75 DAS)	16346 b	37 c
LSD (0.05) for yield = 710.51 LSD (0.05) for Zn uptake= 6.2115			

The analyzed data showed highly significant difference among the treatment means. Maximum fruit yield 17.308 tons/ha and Zn uptake was recorded from the treatment where Zn So_4 was applied @ 30 kg ha^{-1} along with four foliar application of 0.1% Zn @ 45,55,65,75 DAS.

TITLE-44: EFFECT OF DIFFERENT ORGANIC SOURCES OF NUTRIENTS ON GARLIC YIELD

The experiment was conducted to find out the most suitable type and level of organic manures for organic production of garlic. The experiment was laid out in RCBD with three replications having a plot size of 2.6 m × 6.0 m. Row and plant spacing were maintained as 20 cm and 10 cm, respectively. The organic manure used were FYM 5t ha^{-1}, FYM 10t ha^{-1}, Vermicompost 3t ha^{-1}, Sugarcane press mud 5t ha^{-1}, Sugarcane press mud 10t ha^{-1} along with control where no organic manure was applied.. The maximum garlic yield of19.85 tons ha^{-1} was recorded from the treatment where the combination of the FYM and sugar press mud @ 5 t ha^{-1} for both the manures.

Comparison of different organic manures on garlic yield

Treatments	Yield/plot (Kg)
T_1 = FYM 5 t ha^{-1}	17.35 d
T_2 = FYM 10 t ha^{-1}	18.10 cd
T_3 = Vermicompost 3 t ha^{-1}	18.57bc
T_4 = Sugarcane press mud 5 t ha^{-1}	18.60bc
T_5 = Sugarcane press mud 10 t ha^{-1}	19.52ab
T_6 = FYM 5 t ha^{-1} + Sugarcane press mud 5 t ha^{-1}	19.85 a
LSD (0.05) for yield = 0.9471	

TITLE-45: EFFECT OF DIFFERENT ORGANIC SOURCES OF NUTRIENTS ON TURMERIC YIELD

The experiment was conducted to find out the most suitable type and level of organic manures for organic production of turmeric. The experiment was laid out in RCBD with three replications having a plot size of 2.1 m × 7.0 m. Row and plant spacing were maintained as 70 cm and 20 cm, respectively. The organic manure used were FYM 5t ha^{-1}, FYM 10t ha^{-1}, Sugarcane press mud 5t ha^{-1}, Sugarcane press mud 10t ha^{-1} along with control where no organic manure was applied.

Turmeric yield data reveals significant difference among the organic manure treatments. The maximum turmeric yield of 15.675 tons ha^{-1} was recorded from the treatment where the combination of the FYM and sugar press mud @ 5 t ha^{-1} for both the manures.

TITLE-46: EFFECT OF DIFFERNET LEVELS OF NP FERTILIZER ON THE YIELD OF BRASSICA

The Experiment was conducted to find out the most suitable combination of N and P to get maximum yield of Brassica Napus. The experiment was laid out in RCBD with split plot arrangements havingthree replications and plot size of 1.8 m x 6.0 m.Row and plant spacing 40 cm and 15 cm respectively. The levels of phosphorus and nitrogen used were 60, 75, 90 and 60,75,90,105 kg ha^{-1} respectively. The maximum seed yield (3295 kg ha^{-1}) was recorded from the treatment where N& Pwas applied @ 105,90kg ha^{-1}respectively.

Yield of canola as affected by different NP levels

	Seed Yield (t ha^{-1})			
Fertilizer	**P levels**			**Fertilizer**
(N levels)	60	**75**	60	**(N levels)**
60	2071 l	2592 h	2962 d	2542
75	2231 k	2682 g	3055 c	2656
90	2312 j	2772 f	3168 b	2751
105	2424 i	2889 e	3300 a	2871
Average	2260	2734	3121	

TITLE-47: EFFECT OF DIFFERNET LEVELS OF NP FERTILIZER ON THE YIELD OF BRASSICA

The Experiment was conducted to find out the most suitable combination of N and P to get maximum yield of Brassica Juncea. The experiment was laid out in RCBD with split plot arrangements having three replications and plot size of 1.6 m x 5.0 m.The trial was sown on 14-10-2013 with row and plant spacing was maintained 40 cm and 15 cm respectively. The levels of phosphorus and nitrogen used were 0,60,75,90 and 0,60,75,90,105 kg ha^{-1} respectively. The phosphorus levels was in main plot while N levels in sub plot. The crop was harvested; threshed and seed yield data was recorded and analyzed statistically.

TITLE-48: SEED YIELD (kg ha^{-1}) OF BRASICA JUNCEA AS AFFECTED BY DIFFERENT (NP) LEVEL

The analyzed data shows that the effect of P & N and their interaction was highly significant. The maximum seed yield (4083 kg ha^{-1}) was recorded from the treatment where N and P were applied @ 75-75 kg ha^{-1} which did not differ significantly from 90-0,90-75,75-0 and 60-0 N&P levels produced seed yield 3875,3667,3583 and 3437 respectively .The minimum seed yield of 2667 kg ha^{-1} was recorded from the treatment where 0-60 kg ha^{-1} NP applied.

N levels kg ha^{-1}	P levels kg ha^{-1}				**Mean**
0	**0**	**60**	**75**	**90**	
60	2875c-h	2667g-h	2312h	2708gh	2641B
75	3437a-g	2792fgh	3297b-g	3146b-g	3167A
90	3875ab	2793f-h	3667abc	3250b-g	3297A
105	3625abcd	3000c-h	3541a-f	3042c-h	3302A
Mean	3479A	2787B	3379A	2995B	

LSD value for P at 5% = 247.37
For N = 294.76
For interaction = 781.89

TITLE-49: EFFECT OF DIFFERENT SOWING DATES ON THE YIELD CANOLA

The experiment was conducted to find out the optimum sowing time to get maximum yield in new strain of Canola. The experiment was laid in split plot design with three replications having a plot size of 1.8 m × 6.0 m. Row and plant spacing maintained at 45 cm and 15 cm. Sowing dates were in main plot and varieties in sub plot. Sowing dates were 1st September, 15th September, 1st October, 15th October, 1st November and 15th November, 2013. The Canola strains ZBJ 08051, UAF-11 and Anmol Raya were used as test material. The yield data was recorded and analyzed statistically.

TITLE-50: YIELD OF CANOLA AS AFFECTED BY DIFFERENT SOWING DATES (kg/ha)

Varieties	Sowing dates						Mean
	1st sep	15th Sep	1st Oct	15th Oct	1st Nov	15th Nov	
UAF-11	169k	524jk	2469b-e	2160d-f	1358hi	802j	1247C
Anmol Raya(check)	2284c-f	1975efg	3549a	2963b	1543gh	880ij	2199A
ZBJ 08051	1450h	1512gh	2685bc	2654bcd	1852fgh	864ij	1836B
Mean	1301D	1337D	2901A	2592B	1584C	849E	

LSD value for varieties at 5% = 132.01
Dates = 229.89
For interaction = 496.52

Grain yield

The analyzed data shows highly significant difference among the varieties, dates sowing and their interaction. Anmol Raya gave maximum yield (3549 kg/ha) when sown on 1st October, 2013. The minimum yield 169 kg ha-1 was obtained from UAF-11 when sown on 1st September, 2013.

Conclusion

All the varieties/strains performed well at normal sowing i.e. First fortnight of October.

TITLE-51: VARIETAL EFFECT ON THE YIELD OF RAPE SEED(B. NAPUS)

The experiment was conducted to find out the most suitable variety for Rapeseed. The experiment was laid out in RCBD with three replications having plot size 7.0 m × 1.8 m. Row and plant spacing were maintained as 45cm and 15 cm respectively. Seven varieties/strains of Rape seed were tested. The crop was sown on 10-10-2013 and Fertilizer was applied @ 75-75 kg/ha NP. The crop was harvested; threshed and seed yield data was recorded and analyzed statistically.

EFFECT OF VARIETIES ON THE SEED YIELD (KG/HA) OF RAPESEED

S.#	Varieties\strains	Average seed yield
1	KN-263	2428 NS
2	KN-265	2666
3	RBN-04725	2190
4	RBN-05075	2325
5	RBN-07025	2404
6	RBN-09038	2507
7	Faisal Canola	2380

The seed yield data reveals non-significant difference among the varieties.

TITLE-52: EFFECT OF VARIETIES ON THE YIELD OF ZAID KHARIF BRASSICA

The experiment was conducted to find out the most suitable variety for zaidkharif brassica. The experiment was laid out in RCBD with three replications having plot size 6 m × 1.8 m. Row and plant spacing were maintained as 45cm and 15 cm respectively. Ten strain/varieties of zaidkharif brassica were tested. The crop was sown on 14-9-2013 and Fertilizer was applied @ 75-75 kg/ha NP. The seed yield data was recorded and analyzed statistically.

Effect of Strains/Varieties on the Yield of ZaidKharif Brassica

S.#	Varieties\strains	Average seed yield
1	ZBJ-10020	1975ab
2	ZBJ-10021	2222a
3	ZBJ-08047	1543c
4	ZBJ-09007	2099ab
5	ZBJ-11030	1790bc
6	ZBJ-11002	1821bc
7	ZBJ-06012	1605c
8	Raya Anmol	1852bc
9	Toria	648d
10	ZBJ-08051	1821bc

LSD value for varieties at 5% = 336.74

The seed yield data reveals significant difference among the varieties. ZBJ-10021 produced maximum seed yield of 2222 kg/ha which was found to be statistically at par with ZBJ 09007 and ZBJ-10020 produced 2099and 1975 kg ha^{-1} respectively. The minimum seed yield 648 kg/ha was obtained from Toria.

TITLE-53: VARIETAL EFFECT ON THE YIELD OF MUSTARD (B.JUNCEA)

The experiment was conducted to find out the most suitable variety for mustard. The experiment was laid out in RCBD with three replications having plot size 6 m × 1.8 m. Row and plant spacing were maintained as 45cm and 15 cm respectively. Ten varieties/strains of mustard were tested. The crop was sown on 24-09-2013 and Fertilizer was applied @ 75-75 kg/ha NP. The crop was harvested; threshed and seed yield data was recorded and analyzed statistically.

VARIETAL EFFECT ON THE YIELD OF MUSTARD (B.JUNCEA)

S.#	Varieties\strains	Average seed yield
1	KJ-218	1420e
2	KJ-224	1698bcde
3	RBJ-09004	1481de
4	RBJ-09016	1698be
5	RBJ-10001	1698be
6	RBJ-10018	1605ce
7	RBJ-10021	2160a
8	RBJ-10786	2006ab
9	RBJ-11001	1790bcd
10	Khanpur Raya	1883abc

LSD value for varieties at 5% = 352.90

The seed yield data reveals significant difference among the varieties. RBJ-10021 gave maximum seed yield of 2160 kg/ha which was found to be statistically at par with RBJ-10786 and Khanpur Raya produced 2006 and 1883 kg/ha respectively. The lowest seed yield 1420 kg/ha was recorded from KJ-218.

FAROOQABAD

TITLE-54: REGIONAL ADAPTABILITY YIELD TRIAL ON FINE RICE VARIETIES

Experiment was designed to test the yield potential of promising coded lines of Basmati rice provided by the Director, Rice Research Institute, Kala Shah Kaku. The experiment was laid out in Randomized Complete Block Design with 3 replications. Rice nursery was transplanted on 17th of July 2017. All agronomic practices and plant protection measures were kept uniform for all the treatment. Data on paddy yield were noted at maturity and is presented in Table

Table:

Treatments	**Yield kg ha^{-1}**
F I	3813 B
F2	4133 A
F3	3333 C
F4	3443 C
F5	3413 C
F6	3473 C
F7	3540 BC

Critical value for comparison of variety= 305.44

Statistical analysis of the data showed that there was statistically significant difference between different lines/ varieties. However, line F2 gave the highest paddy yield (4133 kg ha^{-1}) followed by the line F1 which gave the paddy yield of 3813 kg ha^{-1}.

While minimum paddy yields (3333 kg ha^{-1}) was produced by the line F3.

TITLE-55: REGIONAL ADAPTABILITY YIELD TRIAL ON COARSE RICE VARIETIES

An experiment was conducted to test the yield potential of promising coded lines of coarse rice varieties/lines provided by the Director, Rice Research Institute, Kala Shah Kaku. The trial was laid out in Randomized Complete Block Design having 3 replications. Rice nursery was transplanted on 17th of July 2017. All agronomic practices and plant protection measures were kept uniform for all the treatment. Data on paddy yield were recorded at maturity and is presented in Table.

Table:

Treatments	**Yield kg ha^{-1}**
MI	4946 A
M2	4033 B
M3	4905 A
M4	5020 A
M5	5046 A
M6	4270 B
M7	4846 A

Critical value for comparison of variety= 283.32

Statistical analysis of the data showed that there was statistically significant difference between different lines/ varieties. However, line M5 gave the highest paddy yield (5046 kg ha^{-1}). While minimum paddy yields (4033 kg ha^{-1}) was produced by the line M2.

TITLE-56: EFFECT OF DIFFERENT SOWING TIMES ON GROWTH AND YIELD OF FINE RICE UNDER DIRECT SEEDED RICE CULTURE

To investigate the best sowing time for different rice varieties in direct seeded rice a trial was laid out in Split Plot Design having three replications. Treatments were comprised of two factors

A. **Sowing Dates**

1. 2nd week of may
2. 1st week of June
3. 3rd week of June

B. **Varieties**

1. Super Basmati
2. Basmati-515
3. PS-2

Sowing dates were kept in main plots while rice verities subjected in sub plots. All other agronomic practices were kept uniform for all treatments.
Data on paddy yield and yield components was recorded and presented in table.

Table:

	VI	**V2**	**V3**	**Average**
S_1	2976 b	3106 b	3459 a	3180 A
S_2	2543 cd	2577 c	2605 c	2575 B
S_3	1981 e	2007 e	2253 d	2080 C
Average	2500 B	2563 B	2772 A	

Critical value for comparison of variety= 109.09
Critical value for comparison of sowing date= 265.50
Critical value for comparison of interaction=305.19

Statistical analysis of the data showed the significant differences among the treatment means. According to the data maximum paddy yield (3459kg ha^{-1}) was obtained from the plot where rice variety PS-2 was sown on 2nd week of May and followed by the plot where rice variety Basmati-515 was sown in 2nd week of May 2017.

While the minimum paddy yield (1981 kg ha^{-1}) was obtained from the plots where rice variety SUPER BASMATI was sown in 3rd week of June 2017

TITLE-57: EFFECT OF DIFFERENT SOWING TIMES ON GROWTH AND YIELD OF COARSE RICE UNDER DIRECT SEEDED RICE CULTURE

To investigate the best sowing time for different rice varieties in direct seeded rice a trial was laid out in Split Plot Design having three replications. Treatments were comprised of two factors

A. Sowing Dates

1. 1st week of May
2. 3rd week of May
3. 1st week of June

B. Varieties

1. KSK-133
2. KSK- 434
3. IR-6

Data on paddy yield and yield components was recorded and presented in table.

Table:

	VI	**V2**	**V3**	**Average**
S_1	3655a	3589a	2823bcd	3356 A
S_2	3057 b	2947 bc	2716 cd	2907 B
S_3	2588 d	2575 d	2012 e	2391 C
Average	3100 A	3037A	2517 B	

Critical value for comparison of variety=146.57
Critical value for comparison of sowing date=191.83
Critical value for comparison of interaction=280.44

Statistical analysis of the data showed the significant differences among the treatment means. According to the data maximum paddy yield (3655kg ha^{-1}) was obtained from the plot where variety KSK-133 was sown on 1st week of May 2017 and remain statistically at par with the plot where the rice variety KSK-434 was sown in 1st week of May which gave the paddy yield of (3589 kg ha^{-1}).

While minimum paddy yield (2012 kg ha^{-1}) was obtained from the plots where rice variety IR-6 was sown in 1st week of June 2017.

TITLE-58: EFFECT OF DIFFERENT PLANT SPACING AND FERTILIZER AMOUNT ON GROWTH AND YIELD OF TRANSPLANTED RICE (*ORYZA SATIVA L*).

To explore the scope of rice intensification systems a trial was laid out in Split Plot Design with three replication. Rice nursery was transplanted on 27th of July 2017. Experiment comprised of following treatments

A. Plant spacing

1. Plant-Plant space 30 cm
2. Plant-Plant space 22.5 cm
3. Plant-Plant space 15 cm

4. Plant-Plant space 10 cm

B. Fertilizer

1. Recommended dose of NPK ((133-67-62 NPK kg ha^{-1})
2. 75 % of recommended dose of NPK.
3. 125 % of recommended dose of NPK.
4. 150 % of recommended dose of NPK

Data on paddy yield and yield related parameters were recorded on the time of harvesting and presented in Table.

Table:

	FI	**F2**	**F3**	**F4**	**Average**
PS_1	3270 j	3032 k	3430 ghi	3416 ghi	3287 C
PS_2	3682 ef	3380 hij	3738 ef	4061 bc	3715 B
PS_3	3932 cd	3581 fg	4137 b	4338 a	3997 A
PS4	3283 ij	3034 k	3471 gh	3814 de	3400 C
Average	3542 C	3257 D	3694 B	3907 A	

Critical value for comparison of Fertilizer= 59.725
Critical value for comparison of Plant spacing= 150.42
Critical value for comparison of interaction= 181.95

Statistical analysis of the data showed the significant differences among the treatment means. According to the data maximum paddy yield (4338 kg ha^{-1}) was obtained from the plot where rice nursery was transplanted by maintaining 15 cm Plant-Plant distance and 150 % of recommended dose of NPK was applied.

While minimum paddy yield (3032 kg ha^{-1}) was obtained from the treatment where rice nursery was transplanted by maintaining 30 cm Plant-Plant distance and 75 % of recommended dose of NPK was applied.

TITLE-59: EFFECT OF TIME AND APPLICATION METHOD OF POTASH ON GROWTH AND YIELD OF FINE RICE.

To find out the best time and method of potash application to reduce lodging, improve yield and quality of rice a trial was laid out in Randomized Complete Block Design having 3 replications. Rice nursery was transplanted on 28th of July 2017. Treatments were as

1. k 0
2. All k as basal (62 kg ha^{-1})
3. All K at 30 DAT (62 kg ha^{-1})
4. ½ K as basal +1/2 At 30 DAT
5. ½ K as basal +Spray of 2 % K solution at 50 DAT.
6. ½ K as basal +Spray of 2 % K solution at 65 DAT.

Data on yield and yield related parameters was recorded and presented in Table.

Table:

Sr. No.	Treatments	Yield kg ha^{-1}
1.	0 K	2455 E
2.	All K as Basal (62 kg ha^{-1})	2906 D
3.	All K at 30 Days after transplanting (62 kg ha^{-1})	3033 C
4.	Half K as Basal+ Half 30 Days after transplanting	3243 B
5.	Half K as Basal+ Spray of 2% K solution at 50 DAT	3356 A
6.	Half K as Basal+ Spray of 2% K solution at 65 DAT	2943 D

Critical value for comparison = 50.276

Statistical analysis of the data showed the significant differences among treatment means. According to the data the application of half dose of recommended Potash as basal and one spray of 2% potash solution at 50 DAT produced significantly maximum paddy yield 3356 kg ha^{-1} While minimum paddy yield (2455 kg ha^{-1}) was obtained from the treatment where no potash was applied

TITLE-60: Chemical Control of Weeds In Direct Seeded Rice.

To find out the best Weedicide to control weeds in DSR a trial was laid out by using RCBD having three replications. Treatments were as under

1. Stomp (pendimethlin) @ 2.5 L ha^{-1} as pre emergence.
2. Stomp (pendimethlin) @ 2.5 L ha^{-1} as pre emergence + Clover 20WP (Bispyribic sodium) @ 200 g ha^{-1} at 25-30 DAS.
3. Stomp (pendimethlin) @ 2.5 L ha^{-1} as pre emergence + Puma super @ 625 mL ha^{-1} at 15 DAS.
4. Stomp (pendimethlin) @ 2.5 L ha^{-1} as pre emergence + Sunstar Gold @ 50 g ha^{-1} 25-30 DAS.
5. Stomp (pendimethlin) @ 2.5 L ha^{-1} as pre emergence + (Sunstar Gold @ 50 g ha^{-1} at 15 DAS + Puma super @ 625 mL ha^{-1}) at 25-30 DAS.
6. Clover 20WP (Bispyribic sodium) @ 150 g ha^{-1} at 15 DAS + Puma super @ 750 mL ha^{-1} at 25-30 DAS.
7. Hand weeding (as and when required)
8. Control

Data on yield and yield related parameters was recorded and presented in Table.

Table:

Treatments	Weeds count m^{-2}	Yield kg ha^{-1}
Stomp (pendimethlin) @ 2.5 L ha^{-1} as Pre-emergence	73.00 B	2240 G
Stomp (pendimethlin) @ 2.5 L ha^{-1} as Pre-emergence+ Clover 20 WP	36.00 CDE	3135 D

(Bispyribic sodium) @ 200 g ha^{-1} at 25-30 Days after sowing		
Stomp (pendimethlin) @ 2.5 L ha^{-1} as Pre-emergence+ Puma super @ 625 m L ha^{-1} at 15 DAS	57.00 BC	2673 F
Stomp (pendimethlin) @ 2.5 L ha^{-1} as Pre-emergence+ Sunstar gold @ 50 g ha^{-1} at 25-30 DAS	22.67 DE	3191 C
Stomp (pendimethlin) @ 2.5 L ha^{-1} as Pre-emergence+ Puma super @ 625 m L ha^{-1} at 25-30 DAS + Sunstar gold @ 50 g ha^{-1} at 50 DAS	8.33 E	3233 B
Clover 20 WP (Bispyribic sodium) at 15 DAS + Puma super at 25-30 DAS	49.33 BCD	2846 E
Hand weeding	4.67 E	3376 A
Control	786.67 A	500 H

Critical value for comparison of weeds count m^{-2}= 32.624
Critical value for comparison of yield= 25.715

Statistical analysis of the data showed the significant differences among treatment means. According to the data maximum paddy yield (3233 kg ha^{-1}**)** after hand weeding**(**3376 kg ha^{-1}) was obtained from the plots where Stomp (pendimethlin) @ 2.5 L ha^{-1} as Pre-emergence , Puma super (Fenoxa Pro-P-Ethyle) @ 625 m L ha^{-1} at 25-30 DAS and Sunstar gold(Ethoxysulfuron) @ 50 g ha^{-1} at 50 DAS were sprayed.
While minimum paddy yield (500 kg ha^{-1}) was obtained from the control (No control of weeds).

TITLE-61: YIELD PERFORMANCE OF PROMISING WHEAT VARIETIES UNDER RICE-WHEAT CROPPING SYSTEM

To find out the best variety of wheat for rice-wheat cropping system. A trial was laid out in Randomized Complete Block Design having 3 replications with a plot size of 4.5m x 8m. Sowing of trial was completed on 23rd of November 2017. Fertilizer @ 120-90-60 NPK kg ha^{-1} was applied. Seed rate was used @ 125 kg ha^{-1}. The inter row spacing was maintained at 22.5cm. All other crop management practices were kept uniform. Yield data was recorded (kg ha^{-1}) and is presented in Table.

Table:

Treatments	**Yield (Kg/ha)**
Anaj-2017	3804 C
Ujala-2016	4047 BC
Galaxy-2013	4531 A
Punjab-2011	3991 C
Faisalabad-2008	3860 C
Sahar-2008	4270 B
Inqlab-91	3485 D

Critical value for comparison= 255.65

Statistical analysis of the data showed significant differences among wheat varieties. Wheat variety Galaxy-2013gave the maximum grain yield (4531 kg ha^{-1}) followed by Sahar-2008 which produced the yield of (4270 kg ha^{-1})

Lowest wheat yield of (3485 kg ha^{-1}) was obtained from plots where wheat variety Inqlab-91 was sown.

TITLE-62: EFFECT OF IRRIGATION SCHEDULE ON GROWTH AND YIELD OF LINSEED (*LINUM USITATISSIMUM*)

To study the effect of different irrigation schedule on linseed yield an experiment was conducted in Randomized Complete Block Design having three replications with a plot size of 4.5 m × 8 m. Trial was sown on 9th of November and Linseed variety Chandni was used as testing material. Treatments were as under

1. One irrigation before branching (30 days after sowing)
2. One irrigation before flowering (50 days after sowing)
3. One irrigation before capsule formation (70 days after sowing)
4. Two irrigations before branching and flowering (30 & 50 DAS)
5. Two irrigations before branching and capsule formation (30 & 70 DAS)
6. Two irrigations before flowering and capsule formation (50 & 70 DAS)
7. Three irrigations before branching, flowering and capsule formation (30,50 & 70 DAS)

Data on yield and yield components were recorded during the course of experiment and presented in kg ha^{-1} in table.

Table:

Treatments	**Yield (Kg/ha)**
One Irrigation before branching (30 Days After Sowing)	788 C
One Irrigation before flowering (50 DAS)	739 CD
One Irrigation before capsule formation (70DAS)	682 D
Two Irrigations before branching & flowering (30 &50 DAS)	887 B
Two Irrigations before branching & capsule formation (30 &70 DAS)	964 B
Two Irrigations before flowering & capsule formation (50 &70 DAS)	1117 A
Three Irrigations before branching, flowering & capsule formation (30,50 &70 DAS)	1152 A

Critical value for comparison = 77.316

Statistical analysis of the data showed significant difference among treatment means. The maximum linseed production (1152 kg ha^{-1}) was obtained where three irrigations before branching, flowering and capsule formation (30, 50 & 70 DAS) were applied and remain at par with plot where two irrigations before flowering and capsule formation (50 & 70 DAS) were applied which produced the grain yield of (1117 kg ha^{-1}).

While the minimum grain yield of (682 kg ha^{-1}) was obtained from the plot where one irrigation was applied before capsule formation (70 days after sowing)

Table: Meteorological Data (November 2017-April 2018)

Month	Rainfall (mm)	Mean Temperature (^{o}C)	
		Maximum	Minimum
Nov	1.6	24.7	12.1
Dec	7	23.6	7.2
Jan	0	21.1	5.7
Feb	7	23.7	7.5
March	7.4	29.8	12.8
April	1.1	36.4	19.6

TITLE-63: EFFECT OF FOLIAR APPLICATION OF ZINC ON THE YIELD OF WHEAT AT DIFFERENT GROWTH STAGES

To find out best time and rate of Zn application to improve yield and quality of wheat a trial was laid out in Split plot design with three replications. Trial was sown on 23rd November and wheat variety Glaxy-2013 was used as testing material. Treatments comprised of two factors

A. Zinc level

Zn_1 = 0.02% Zn solution

Zn_2 =0.04% Zn solution

Zn_3 =0.06% Zn solution

B. Growth stages

S_1 =Tillering

S_2 =Booting

S_3 =Heading

S_4 =Grain filling

Data on wheat grain yield and yield components was recorded and presented in table.

Table:

	GS1	GS2	GS3	GS4	Means
ZN1	3673 e	4179 cd	4183 cd	4385 bc	**4105 C**
ZN2	4083 d	4235 cd	4216 cd	4797 a	**4333 B**
ZN3	4254 cd	4703 a	4610 ab	4872 a	**4610 A**
Means	**4003 C**	**4372 B**	**4336 B**	**4685 A**	

Critical value for comparison of growth stages =236

Critical value for comparison of Zn levels =104.72

Critical value for comparison of interaction =291

Statistical analysis of the data showed the significant differences among treatment means. According to the data maximum wheat yield (4872 kg ha^{-1}) was obtained from the treatment where 0.06% Zn solution was sprayed at grain filling stage. While minimum wheat yield (3673 kg ha^{-1}) was obtained from the treatment where 0.02% Zn solution was applied at tillering stage.

TITLE-64: COMPARISON OF DIFFERENT SYMBIOTIC AND NON SYMBIOTIC BACTERIA ON GROWTH AND YIELD OF CANOLA

To find out the suitable PGPR for increase in yield of canola a trial was laid out in Randomized Complete Block Design with three replication. Trial was sown on 9th November 2017. Treatments were as under

1. No PGPR
2. Azotobactor
3. Rhizobium
4. Azotobactor+Rhizobium
5. EM-1
6. EM-1+ Azotobactor+Rhizobium

Data on grain yield and yield components was recorded and presented in table.

Table:

Treatments	**Yield (Kg/ha)**
No PGPR	1696 C
Azotobactor	1798 BC
Rhizobium	1797 BC
Azotobactor+Rhizobium	1839 AB
EM-1	1930 A
EM-1+ Azotobactor+Rhizobium	1822 AB

Critical value for comparison =117.65

Statistical analysis of the data showed the significant differences among treatment means. According to the data maximum canola yield (1930 kg ha^{-1}) was obtained from the plot treated with EM-1. While minimum canola yield (1696 kg ha^{-1}) was obtained from the plot where no PGPR was applied.

TITLE-65: DIFFERENT RICE STUBBLE MANAGEMENT PRACTICES IN WHEAT

To find out best rice stubble management practices in rice wheat cropping system a trial was laid out in randomized complete block design having four replications. Sowing of trial was completed on 5th of December 2017. Fertilizer @ 120-90-60 NPK kg ha^{-1} was applied. Seed rate was used @ 125 kg ha^{-1}. The inter row spacing was maintained at 22.5cm. All other crop management practices were kept uniform. Yield data was recorded (kg ha^{-1}) and is presented in table.

Table:

Treatments	**Yield (Kg/ha)**
Half retention of stubble (zero tillage)	3779 A
Half retention of stubble (conventional)	3179 B
Half retention of stubble (Rotavator)	3217 B
Half retention of stubble (Burning and conventional sowing)	3048 B

Critical value for comparison =325.38

Statistical analysis of the data showed the significant differences among treatment means. According to the data maximum wheat yield (3779 kg ha^{-1}) was obtained from the treatment where half retention of stubble (zero tillage) was done.

While minimum wheat yield (3048 kg ha^{-1}) was obtained from the treatment where Half retention of stubble (Burning and conventional sowing) was done.

KHANEWAL

Title-66: FRUIT SHEDDING STUDY ON THE PROMISING COTTON VARIETIES UNDER KHANEWAL CONDITIONS

This study was conducted to evaluate the effect of plant population and environment on fruit shedding of cotton crop. Cotton varieties MNH-992, Cyto-179, FH-998 and FH-142 were sown at three different plant spacing i.e. 15, 30 and 45 cm using randomized complete block design in factorial arrangement with three replications. Net plot size was 3.0 m × 6.0 m. Fertilizer was applied @ 150-60-62 NPK kg ha^{-1}. All other agronomic practices were kept uniform. Experiment was sown on 10-05-2017.

Seed cotton yield (kg ha^{-1})				
Varieties	**Plant Spacing (cm)**			**Mean**
	15	**30**	**45**	
MNH-992	2128 cd	2227ab	2047 d	2134
CIM-179	2073 cd	2145 bc	2109 cd	2109
FH-Lalazar	2142 bc	2154 bc	2080 cd	2125
FH-142	2109 cd	2245 a	1943 e	2098
Mean	2113 B	2192 A	2044 C	
LSD for varieties = 136.30 **LSD for plant spacing= 54.1** **LSD for plant spacing × varieties= 86.0**				

Results of this study showed that cotton variety FH-142 gave maximum seed cotton yield of 2245 when sown at 30 cm plant to plant distance followed by MNH-992 with 2227 kg ha^{-1} at similar plant spacing while minimum was recorded in FH-142 with 1943 kg ha^{-1} sown at 45 cm spaced rows.

In conclusion good crop yield of cotton can be obtained by sowing FH-142 with plant to plant distance of 30 cm under Khanewal conditions. All varieties performed best at 30 cm plant to plant spacing under Khanewal condition while at 45 cm plant to plant spacing considerable yield reduction was recorded.

Title-67: INTERCROPPING OF MUNGBEAN IN COTTON SOWN UNDER DIFFERENT PLANTING METHODS

This study was conducted to evaluate the potential of mungbean intercropping in cotton in enhancing farm productivity. Four intercropping techniques were used i.e. T_1= cotton sown in 75 cm spaced rows + mungbean broadcasted; T_2= cotton sown in 75 cm spaced rows + one line of mungbean between two consecutive rows of cotton; T_3= cotton sown in 75 cm spaced rows + 30 cm spaced two rows of mungbean between two consecutive rows of cotton and T_4= cotton sown on 75 cm spaced raised beds + 30 cm spaced two rows of mungbean on top of bed. Trial was sown employing randomized complete block design with three replications; in plots measuring 3.0 m × 6.0 m. Cotton variety CIM-616 and mungbean variety AZRI-2006 were kept in this study. Row and plant spacing of 75 cm and 30 cm respectively were maintained for cotton while mungbean row spacing of 30 cm was maintained. Fertilizer was applied @ 150-62-60 NPK kg $ha^{-1}$was applied. All other agronomic practices were kept uniform. Trial was sown on 11-05-2017 and mungbean was harvested on 10-08-2017.

Treatments	**Yield (kg ha^{-1})**		**Net Income (Rs./ ha)**		
	Cotton	**Mung**	**Cotton**	**Mung**	**Total**
T_1	2458	856	76412	12977	89389
T_2	2491	721	78972	11940	90912
T_3	2483	798	78012	13460	91472
T_4	2433	815	76892	14090	90982
Rate/40 kg = Cotton 3200, Mung 2250					

Results showed that cotton crop sown at 75 cm spaced rows + one line of mungbean between two consecutive rows of cotton and cotton crop sown at 75 cm spaced rows + 30 cm spaced two rows of mungbean between two consecutive rows of cotton gave the maximum seed cotton yield of 2491 and 2483 kg ha^{-1} respectively. While maximum yield of mungbean i.e. 850 kg ha^{-1} was recorded when it was sown by broadcast method between two 75 cm spaced rows of cotton. Moreover maximum net income of Rs. 91472 was recorded when cotton sown in 75 cm spaced rows + 30 cm spaced two rows of mungbean between two consecutive rows of cotton.

In conclusion cotton and mungbean can be sown by cotton crop sown at 75 cm spaced rows + two lines of mungbean between two consecutive rows of cotton to get more farm income.

Title-68: ECONOMIC EVALUATION OF DIFFERENT CROPPING SYSTEMS UNDER KHANEWAL CONDITION

This study was conducted to evaluate the suitable cropping system that can provide maximum income per year. Seven different cropping systems were evaluated i.e. T_1= cotton-wheat-cotton-wheat-cotton–wheat, T_2=cotton/wheat-cotton/wheat-cotton/wheat (relay), T_3=rice-wheat-rice-wheat-rice-wheat, T_4=cotton-fallow-cotton-fallow-cotton-fallow, T_5=cotton/berseem-cotton/berseem-cotton/berseem (relay), T_6=cotton/raya-cotton/raya-cotton/raya (relay) and T_7=mung-wheat-cotton -wheat-mung-wheat. Crop was sown using RCBD in plots measuring 1 kanal. Cotton variety FH-142 and rice variety Super Kaynat were used in this experiment. Row and plant spacing of 75 cm and 30 cm respectively were maintained for cotton while row spacing for rice was kept at 22.5 cm. Fertilizer was applied @ 150-62-60 kg ha^{-1} in cotton. All other agronomic practices were kept uniform. Rice nursery was sown on 17-05-2017 while rice was transplanted on 22-06-2017 and cotton was sown on 02-05-2017.

Maximum yield of cotton i.e. 4788 kg ha^{-1} was recorded in T_7 (Mung-Wheat-**Cotton** -Wheat-Mung-Wheat) followed by T_2 (Cotton – Wheat – **Cotton** –Wheat-Cotton-Wheat [relay]) 4182 kg ha^{-1} while minimum was recorded in T_6 (Cotton/Raya-**Cotton**/Wheat-Cotton/Raya [(Relay]) 2303 kg ha^{-1}.

	Cropping system	**Seed cotton yield (kg ha^{-1}) 2017**
T_1	Cotton – Wheat – **Cotton** –Wheat-Cotton-Wheat	2727
T_2	Cotton/Wheat – **Cotton**/Wheat- Cotton/Wheat (Relay)	4182
T_3	Rice-Wheat-**Rice**-Wheat-Rice-Wheat	8727 (paddy yield)
T_4	Cotton- Fallow-**Cotton**-Wheat-Cotton-Fallow	3333
T_5	Cotton/Berseem-**Cotton**/Wheat-Cotton/Berseem (Relay)	3152
T_6	Cotton/Raya-**Cotton**/Wheat-Cotton/Raya (Relay)	2303
T_7	Mung-Wheat-**Cotton** -Wheat-Mung-Wheat	4788

Note: Rabi crops are in field after harvesting of Rabi crops the economical analysis of whole year will be done.

Title-69: MINIMIZING SQUARE/FLOWER SHEDDING IN BT. COTTON WITH NUTRIENT MANAGEMENT

This study was conducted to find out the best suitable nutrient management to control flower / square shedding of new BT varieties / strains under Khanewal conditions. Cotton variety FH-142 was sown with 3 different levels of boron i.e. 1, 1.5 and 2 kg ha^{-1} and two levels of potassium 95, 110 kg ha^{-1}.The trial was conducted in RCBD under factorial arrangement with three replications; in plots measuring 3.0 m × 6.0 m. Cotton was sown on raised beds in 75 cm spaced rows maintaining P × P distance of 30 cm. NP @ 150-62 kg ha^{-1} was applied. All other agronomic practices will be kept uniform. Experiment was sown on 10-05-2017.

Seed cotton yield (kg ha^{-1})			
Treatments	**Potassium**		**Mean**
Boron	**95 kg ha^{-1}**	**110 kg ha^{-1}**	
1 kg ha^{-1}	1221	1322	1272
1.5 kg ha^{-1}	1247	1334	1291
2 kg ha^{-1}	1280	1455	1368
Mean	1250 B	1371 A	
LSD for Potassium at 0.05= 187.9			

Application of B has no significant effect on seed cotton yield, however potassium, application of 110 kg ha^{-1} gave more seed cotton yield of 1371 kg ha^{-1} as compared with 95 kg K ha^{-1}.

Hence it is concluded that application of Potassium 110 kg ha^{-1} along with B has potential to boost the seed cotton yield.

Title-70: Adaptation of New Bt-Cotton Varieties/Strains under Different Planting Times

The experiment was conducted to find out the best time of sowing to get the maximum seed cotton yield potential of three promising varieties / strains of cotton under Khanewal conditions. The strains / varieties viz. FH-992, CIM-179 and FH-Lalazar were tested on 15/03, 01/04, 15/04, 01/05, 15/05. Sowing was laid out in split plot design in three replications on beds, keeping sowing dates in main plots and varieties / strains in sub-plots of size 3 m × 6 m. The fertilizer was applied @ 150-60-62 NPK kg ha^{-1}. All the agronomic practices and plant protection measures were kept uniform.

Seed cotton yield (kg ha^{-1})				
Treatments	**MNH-992**	**CIM-179**	**FH-Lalazar**	**Mean (kg ha^{-1})**
3rd week of March	3091	3257	3183	3177 A
1st week of April	3128	3198	2820	3049 A
3rd week of April	2747	2336	2917	2667 A
1st week of May	2011	1965	2053	2010 B
3rd week of May	797	699	732	743 C
Mean (kg ha^{-1})	2355	2291	2341	
LSD for sowing dates at 0.05= 650 **LSD for varieties at 0.05= 250** **LSD for sowing dates×varieties at 0.05= 559**				

The experiment revealed that the sowing of cotton from 3rd week of March to 3rd week of April gave more yield 3177 to 2667 kg ha^{-1} while further delay in sowing results in considerable reduction in seed cotton yield.

In conclusion optimum time of cotton to attain maximum yield is 3rd week of March to 3rdweek of April under Khanewal conditions.

Title-71: PROVINCIAL COORDINATED COTTON TRIAL (PCCT) FOR YIELD PERFORMANCE UNDER KHANEWAL CONDITIONS

The study was conducted to see the performance of different varieties / strains of cotton under Khanewal conditions for yield performance. Experiment was conducted in RCBD with three replications and net plot size of 3.0 × 4.6 m. Two sets of varieties / strains i.e. BT; fourty promising varieties / strains; V_1-V_{40} and non-BT; four promising varieties / strains; V_1-V_4 were tested for yield performance under Khanewal conditions. The fertilizer was applied @ 150-60-62 NPK kg ha^{-1}. All the agronomic practices and plant protection measures were kept uniform. The experiment was sown on 11.05.2017.

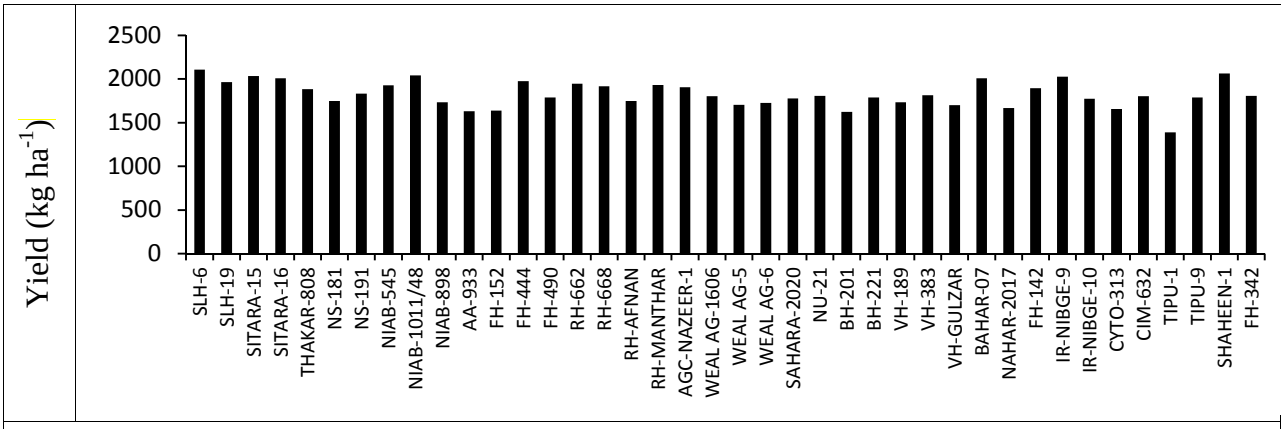


Figure 1: Seed cotton yield of BT-cotton varieties under Khanewal conditions

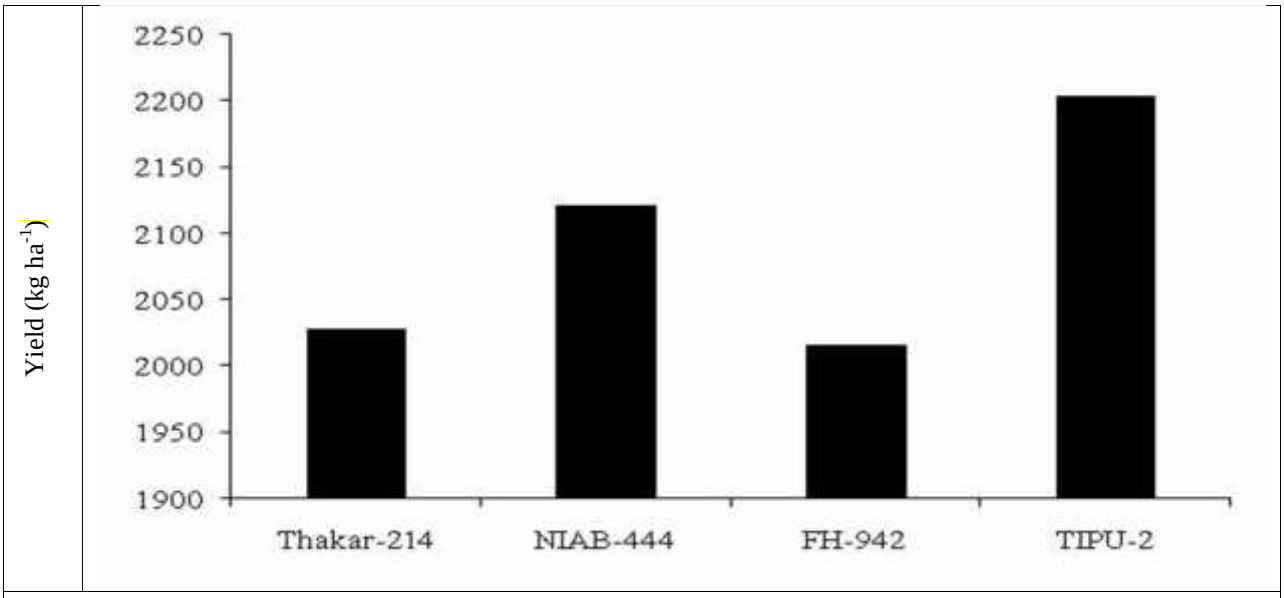


Figure 2: Seed cotton yield of non-BT-cotton varieties under Khanewal conditions

In Bt-cotton varieties the variety / strain SLH-6 gave best results with seed cotton yield of 2106 kg $ha^{-1,}$ followed by variety / strain Shaheen-1 with seed cotton yield of 2061 kg ha^{-1}. The lowest seed cotton yield of 1390 kg ha^{-1} was recorded by variety Tipu-1. In non-Bt-varieties; the variety / strain Tipu-2 gave best results with seed cotton yield of 2204 kg ha^{-1}, followed by variety / strain NIAB-444 with seed cotton yield of 2122 kg ha^{-1}. The lowest seed cotton yield of 2016 kg ha^{-1} was recorded by variety / strain FH-942.

Hence, it can be concluded from results that in Bt-cotton varieties SLH-6 performed best while in non-Bt varieties TIPU-2 gave best results

Title-72: PERFORMANCE OF BT-COTTON VARIETIES/STRAINS UNDER KHANEWAL CONDITIONS

The trial was conducted to find out the best seed cotton yield of ten BT-Cotton strains / varieties viz. FH-142, FH-998, BH-184, VH-201, VH-305, VH-383, VH-384, CIM-616, CIM-179, and MNH-992 under Khanewal conditions. The experiment was sown on 10.05.2017 and laid out in RCBD with three replications having a plot size of 3.0 m × 6.0 m. Fertilizers @ 150-60-62 NPK kg ha^{-1} were applied. All agronomic practices and plant protection measures were kept uniform.

Varieties	Seed cotton yield (kg ha^{-1})
FH-142	2196 CD
FH-998	2462 A
BH-184	2317 BC
VH-201	2076 DE
VH-305	2343 AB
VH-383	1877 F
VH-384	2050 E
CIM-616	2063 E
CIM-179	1886 F
MNH-992	2306 BC
LSD for varieties at 0.05= 130	

Results showed that maximum seed cotton yields of 2462 WAS recorded in FH-998 followed by VH-305 produced 2343 kg ha^{-1} yield. While minimum seed cotton yield of 1886 kg ha^{-1} was recorded in CIM-179.

In conclusion FH-998 Bt cotton varieties can perform well under Khanewal conditions.

Title-73: NITROGEN UPTAKE AND CROP YIELD OF COTTON AS AFFECTED BY ORGANIC AND INORGANIC N-FERTILIZERS

The experiment was sown on 12.05.16. Various combinations of farmyard manure, poultry manure and slurry were used to observe there optimal level suitable for nitrogen uptake and yield improvement. The experiment was laid out in RCBD with three replications having a plot size of 3 m × 6m on cotton variety FH-142. Recommended dose of P&K was applied. Soil analysis was carried out. All agronomic practices and plant protection measures were kept uniform.

Treatments	Yield (kg ha^{-1})
Control (145-56-62 NPK kg ha^{-1})	1678 E
Poultry Manure (8 t ha^{-1})	1734 D
Farm Yard Manure (10 t ha^{-1})	1793 BC
Slurry (10 t ha^{-1})	1767 C
Urea(30 kg ha^{-1}+ Poultry Manure 6 t ha^{-1})	1822 AB
Urea 30 kg ha^{-1}+ Farm Yard Manure 8 t ha^{-1}	1845 A
Urea 30 kg ha^{-1}+ Slurry 8 t ha^{-1}	1673 E
Urea 60 kg ha^{-1}+ Poultry Manure 3 t ha^{-1}	1806 B
Urea 60 kg ha^{-1}+ Farm Yard Manure 4 t ha^{-1}	1772 C
Urea 60 kg ha^{-1}+ Slurry 4 t ha^{-1}	1805 B
LSD of treatments at 0.05=32.3	

The treatment Urea @ 30 kg ha^{-1}+ farm yard manure @ 8 tons ha^{-1} gave the highest seed cotton yield of 845 kg ha^{-1} followed by Urea @ 30 kg ha^{-1}+ slurry @ 8 tons ha^{-1} with seed cotton yield of 1822 kg ha^{-1}. While the lowest seed cotton yield of 1678 and 1673 kg ha^{-1}were recorded in control and urea 30 kg ha^{-1}+ slurry 8 t ha^{-1} respectively.

In conclusion Urea @ 30 kg ha^{-1}+ farm yard manure @ 8 tons ha^{-1} and Urea @ 30 kg ha^{-1}+ slurry @ 8 tons ha^{-1} had potential to boost the cotton yield.

Title-75: GUAR ADAPTATION YIELD TRIAL

The experiment was sown on 20.06.2017 to evaluate the yield performance of advanced lines against existing approved varieties. Four strains S-5789, S-5823, S-5885, S-6036 were tested against one standard BR-2017. The experiment was laid out in RCBD with three replications having a plot size of 3.0 m × 4.6 m. All agronomic practices and plant protection measures will be kept uniform.

The highest yield was recorded in line S-5885 with grain yield of 1641 kg ha^{-1} followed by line S-5823 with grain yield of 1509 kg ha^{-1}.

Yield (kg ha^{-1})				
Varieties	**R_1**	**R_2**	**R_3**	**Mean**
S-5789	1382	1366	1212	1320
S-5823	1420	1580	1526	1509
S-5885	1576	1700	1646	1641
S-6036	1218	1286	1238	1247
BR-017	1370	1432	1394	1399

Title-76: EFFECT OF POTASSIUM (K^+) FERTILIZER ON AGRONOMIC TRAITS OF NEW PROMISING LINES OF WHEAT

Experiment was conducted to evaluate the effect of potassium application on agronomic traits of new promising lines of wheat. Two wheat lines 2557 and 2559 were sown keeping row to row distance at 22.5 cm. Four different levels of potassium were tested i.e. T_1= 0 kg ha-^{1,} T_2= 62.50 kg ha^{-1}, T_3= 31.25 kg ha^{-1} and T_4= 93.75 using completely randomized design in factorial arrangement having three replications. Nitrogen and phosphorous were applied at 120 and 90 kg ha^{-1} respectively. Plot size was 1.8 m × 6 m. All other agronomic practices were kept uniform. Experiment was sown on 31-11-2017.

Grain yield (kg ha^{-1})			
Treatments (NPK kg ha^{-1})	**Wheat lines**		**Mean**
	V-2557	**V-2559**	
120-90-00	3833	4067	3950 B
120-90-31.25	3900	4383	4142 B
120-90-62.5	4400	4567	4483 A
120-90-93.95	4017	4500	4258 A
Mean	4038 B	4380 A	
LSD for wheat Lines at 0.05= 291 **LSD for Potassium dose at 0.05= 412**			

Results of this study revealed that more yield of 4380 kg ha-1 was given by wheat line V-2559 than wheat line V-2557 i.e. 4038 kg ha^{-1}. However among potassium levels, maximum wheat grain yield of 4483 and 4258 kg ha^{-1} was recorded where 62.5 and 93.95 K kg ha^{-1} was applied respectively.

It is concluded that the optimum dose of potassium for wheat is 62.5 kg ha^{-1} to gain more grain yield.

Title-77: PERFORMANCE OF NEW WHEAT VARIETIES / STRAINS UNDER KHANEWAL CONDITIONS (FSD)

Experiment was conducted to evaluate the performance of different wheat strains under Khanewal conditions. Six wheat varieties/ strains i.e. V_1= Ujala-2016, V_2= 8068, V_3= 12001, V_4= 11183, V_5= 10110 and V_6= Galaxy-2013 were sown keeping row to row distance at 22.5 cm. Experiment was laid out in completely randomized design having three replications. Fertilizer was applied at 120-90-62.5 NPK kg ha^{-1}. Plot size was 1.8 m × 6 m. All other agronomic practices were kept uniform. Experiment was sown on 28-11-2017.

Varieties/lines	**Grain yield (kg ha^{-1})**
Ugala-16	4176 D
V-8068	3070 F
V-12001	3854 E
V-11183	4359 B
V-10110	4543 A
Galaxy	4263 C
LSD for varieties/lines at 0.05 = 64	

Maxiumum grain yield of 4543 kg ha-1 was recorded in wheat line V-101110, followed by wheat line V-11183 that gave grain yield of 4359 kg ha-1. However lowest grain yield of 3070 kg ha-1 was recorded in V-8068.

Title-78: COMPARISON OF SOWING METHODS FOR SAVING WATER AND IMPROVING PRODUCTIVITY OF WHEAT

This study was conducted to find out the best sowing method of wheat that may equally effective in requiring less water for irrigation and giving optimum yield. Four sowing methods were compared i.e. drill sowing, broadcast, ridge sowing and bed sowing. Experiment was sown using completely randomized design having three replications. Fertilizer was applied at 120-90-62.5 NPK kg ha^{-1}. Plot size was 3 m × 6 m. All other agronomic practices were kept uniform. Experiment was sown on 31-11-2017.

Treatments	**Grain yield (kg ha^{-1})**
Drill sowing	5333 A
Broadcast	3383 B
Ridge sowing	5150 A
Bed sowing	5889 A
LSD for treatments at 0.05= 758	

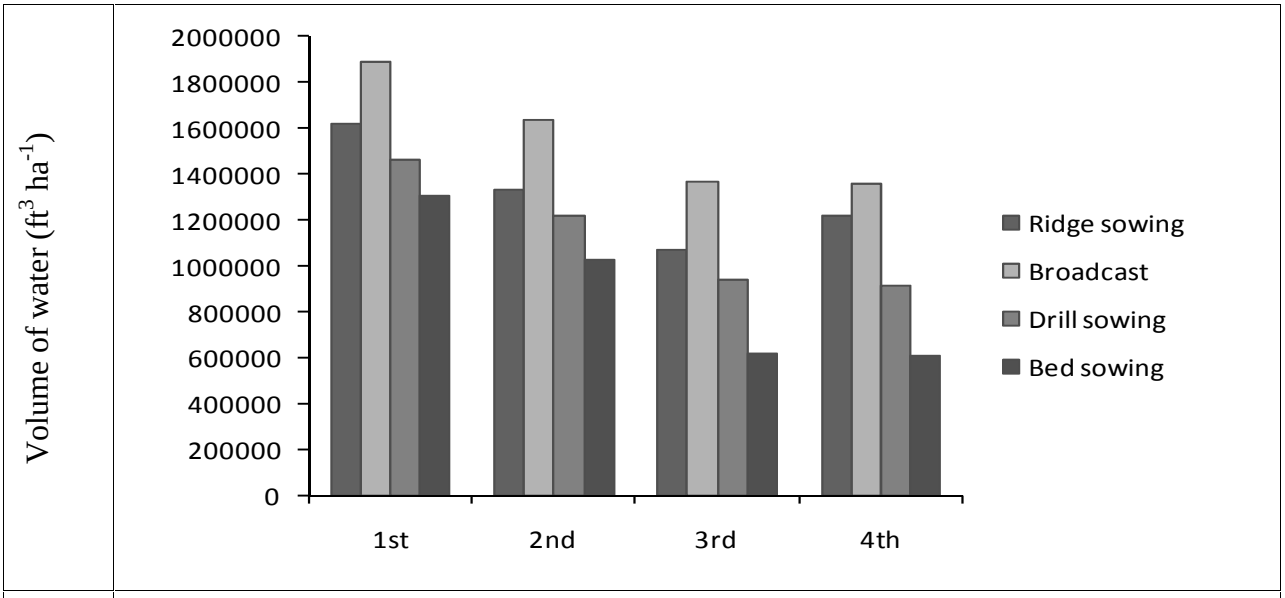


Figure 3: Amount of water applied in each irrigation for each sowing method

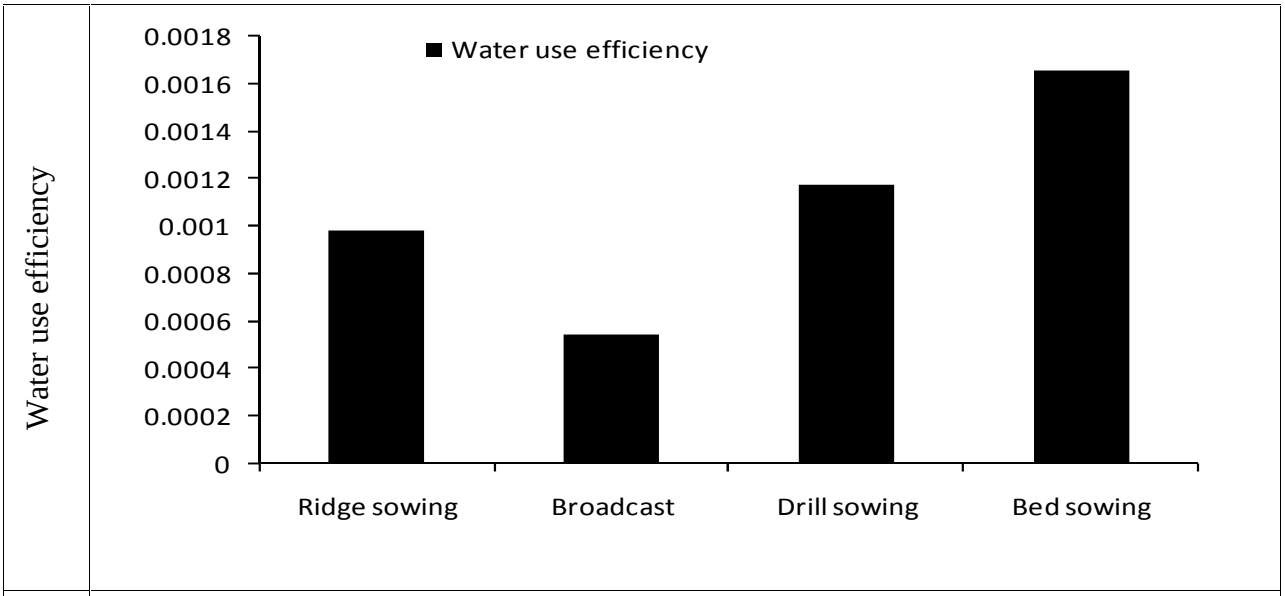


Figure 4: Water use efficiency of sowing methods of wheat

All the sowing methods i.e. bed, drill and ridge gave more yield, 5889, 5333 and 5150 kg ha^{-1} respectively, than broadcast method. Moreover least amout of water was required to irrigate the field sown with bed planting technique Likewise maximum water use efficiency was also given by bed planting technique of eheat sowing.

It can be concluded that wheat may be sown on beds to save water as well as to attain more yield and more water use efficiency.

Title-79: PERFORMANCE OF WHEAT VARIETIES / STRAINS UNDER KHANEWAL CONDITIONS (BWP.)

Performance of different wheat strains under Khanewal conditions. Seven wheat varieties/ strains i.e. V_1= 2557, V_2= 2511, V_3= 1030, V_4= 2559, V_5= Johar-2016 and V_6=Gold-2016 were sown on 28-11-2017 keeping row to row distance at 22.5 cm. Experiment was laid out in completely randomized design having three replications. Fertilizer was applied at 120-90-62.5 NPK kg ha^{-1}. Plot size was 1.8 m × 6 m. All other agronomic practices were kept uniform.

Varieties/ lines	**Grain yield (kg ha^{-1})**
V-2557	4717 A
V-2511	4650 A
V-1030	3050 A
V- 2559	3967 AB
Johar-16	4500 B
Gold-16	4267 A
LSD for wheat varieties/lines at 0.05= 950	

Results of this study showed that all the tested wheat lines V-2557, V-2511 and V-1030 gave more grain yield i.e. 4717, 4650 and 3050 kg ha-1 respectively that approved wheat variety Johar-16.

Title-80: EVALUATING THE OPTIMUM DOSE AND TIME OF FOLIAR APPLICATION OF BORON FOR WHEAT

This study was conducted to evaluate the optimum dose and time of application of boron foliar application to improve wheat yield. This study was comparised of two factors concentration of B solution for foliar spray (basal dose of 2 kg B ha-1, 0.1, 0.01 and 0.001% B solution) and stage of application of spray (tillering, booting and anthesis). Experiment was sown keeping row to row distance at 22.5 cm. Experiment was laid out in completely randomized design in factorial arrangement having three replications. Fertilizer was applied at 120-90-62.5 NPK kg ha^{-1}. Plot size was 1.8 m × 6 m. All other agronomic practices were kept uniform. Experiment was sown on 28-11-2017.

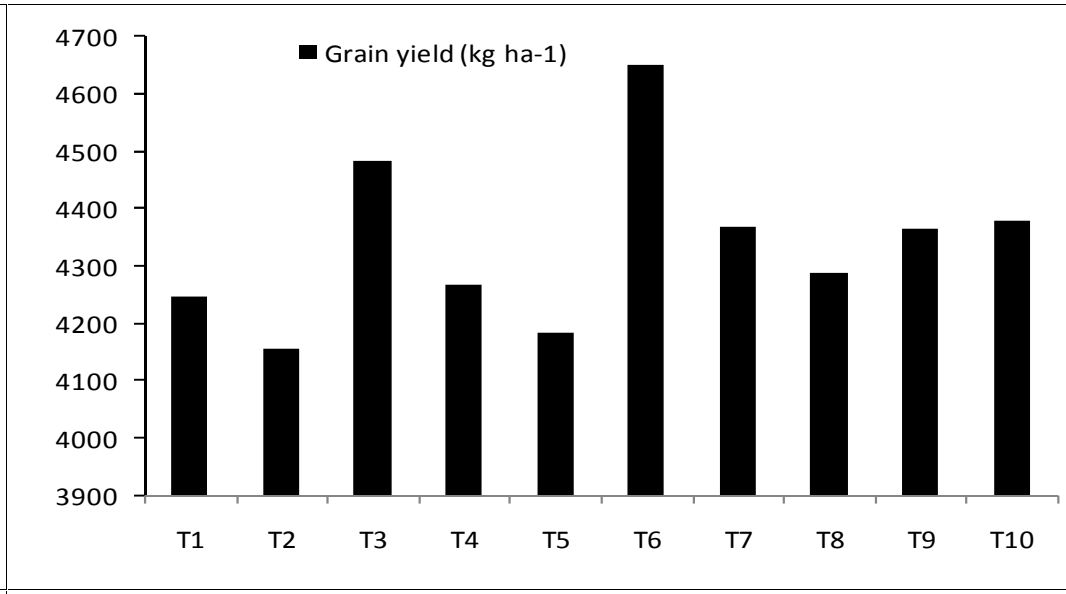


Figure 5: Grain yield of wheat affected by dose and time of foliar application of boron

T_1= Basal dose of 2 kg B ha^{-1} soil application (Control); T_2= 0.1% B solution at tillering; T_3= 0.01% B solution at tillering; T_4= 0.001% B solution at tillering; T_5= 0.1% B solution at booting; T_6= 0.01% B solution at booting; T_7= 0.001% B solution at booting; T_8= 0.1% B solution at anthesis; T_9= 0.01% B solution at anthesis; T_{10}= 0.001% B solution at anthesis;

It is evident from the bar graph that maximum grain yield 4653 kg ha^{-1} yield of wheat was given by 0.01% B solution applied at booting stage, followed by foliar spray of 0.01% B applied at tillering stage. However lowest grain yield of 4158 kg ha-1 was recorded where 0.1% B solution was applied at tillering.

It may be concluded that the best level and time of foliar application of B is 0.01% solution at booting stage to gain more grain yield.

Title-81: ECONOMICAL CROPPING SYSTEM UNDER KHANEWAL CONDITIONS

This study was conducted to evaluate the suitable cropping system that can provide maximum income per year. Seven different cropping systems were evaluated i.e. T_1= cotton-wheat-cotton-wheat-cotton–wheat, T_2=cotton/wheat-cotton/wheat-cotton/wheat (relay), T_3=Rice-wheat-rice-wheat-rice-wheat, T_4=cotton-fallow-cotton-wheat-cotton-fallow, T_5=cotton/berseem-cotton/wheat-cotton-fallow, T_6=cotton/raya-cotton/wheat-cotton/raya (relay) and T_7=mung-wheat-cotton -wheat-mung-wheat. Wheat variety FSD-2008 and Raya variety khanpur raya were used in this experiment. Fertilizer was applied at 120-90-62.5 NPK kg ha-1. All other agronomic practices were kept uniform. Relay crops of wheat, berseem and raya was sown on 10-11-2017 while treatments including conventional wheat crop were sown on 28-11-2017.

ECONOMICAL CROPPING SYSTEM UNDER KHANEWAL CONDITIONS 2017-18						
	Treatment	**Yield (kg ha^{-1})**	**Total Income (Rs)/ ha^{-1}**	**Total Expenditure (Rs)**	**Net Income (Rs)**	**Cost Benefit Ratio (BCR)**
T1	**Cotton-Wheat**	2727+3150	320532	166301	154234	0.92

T2	**Cotton/Wheat**	4182+5900	526310	155897	370413	2.38
T3	**Rice-wheat**	8727+4000	489989	127643	362646	2.84
T4	**Cotton-Fallow**	3333	266640	99536	167104	1.68
T5	**Cotton/Berseem**	3152+fodder	312160	132337	179823	1.36
T6	**Cotton/Raya**	2303+2400	316240	133746	182494	1.36
T7	**Mung-wheat**	890+3950	178437	70175	108262	1.54
Rate/40 kg = Cotton 3200, Wheat 1300, Mung 2250, Raya 2200, Rice Berseem 20000/ha						

Treatment T_3 (rice - wheat) gave maximum economic benefit with Rs. 362646 followed by treatments T_2 cotton/wheat (relay) with Rs. 370413. While treatment T_1 (Cotton + Wheat) gave lowest economic benefit of Rs. 154234.

It is concluded that net income can be enhanced by following rice wheat cropping system as well as the relay sowing of wheat in cotton under Khanewal conditions.

Title-82: COMPARISON OF SOWING METHODS FOR IMPROVING YIELD OF PROMISING LINES OF RAYA UNDER KHANEWAL CONDITIONS

This study was conducted to evaluate the best sowing method and adaptability of advance lines of raya under Khanewal conditions. Raya was sown with three methods i.e. broadcast, drill sowing and ridge sowing. Experiment was laid out in completely randomized design in factorial arrangement having three replications. Plot size was 6 m × 15 m. All agronomic practices were kept uniform. Experiment was sown on 30-10-2017

Yield (kg ha^{-1})			
Sowing methods	**Varieties**		**Mean**
	Khanpur Raya	**Super raya**	
Drill sowing	1444 c	1359 d	1402
Broadcast	1015 f	1274 e	1144
Ridge sowing	1530 b	2119 a	1824
Mean	1330	1584	
LSD for varieties at 0.05= 39 **LSD for sowing methods at 0.05= 28** **LSD for varieties × sowing methods at 0.05= 39**			

Results of this experiment revealed that sowing of super raya variety on ridges gave more yield of 2119 kg ha-1 followed by khanpur raya variety sown on ridges i.e. 1530 kg ha-1. However lowest yield was recorded in broadcast method of sowing i.e. 1274 and 1015 kg ha-1 in super raya and khanpur raya variety respectively.

Hence it may be concluded that rays may be sown on ridges to gain more yield under khanewal conditions.

Title-83: WHEAT RESIDUE MANAGEMENT IN COTTON-WHEAT CROPPING SYSTEM AT ARS, KHANEWAL DURING RABI 2017-18

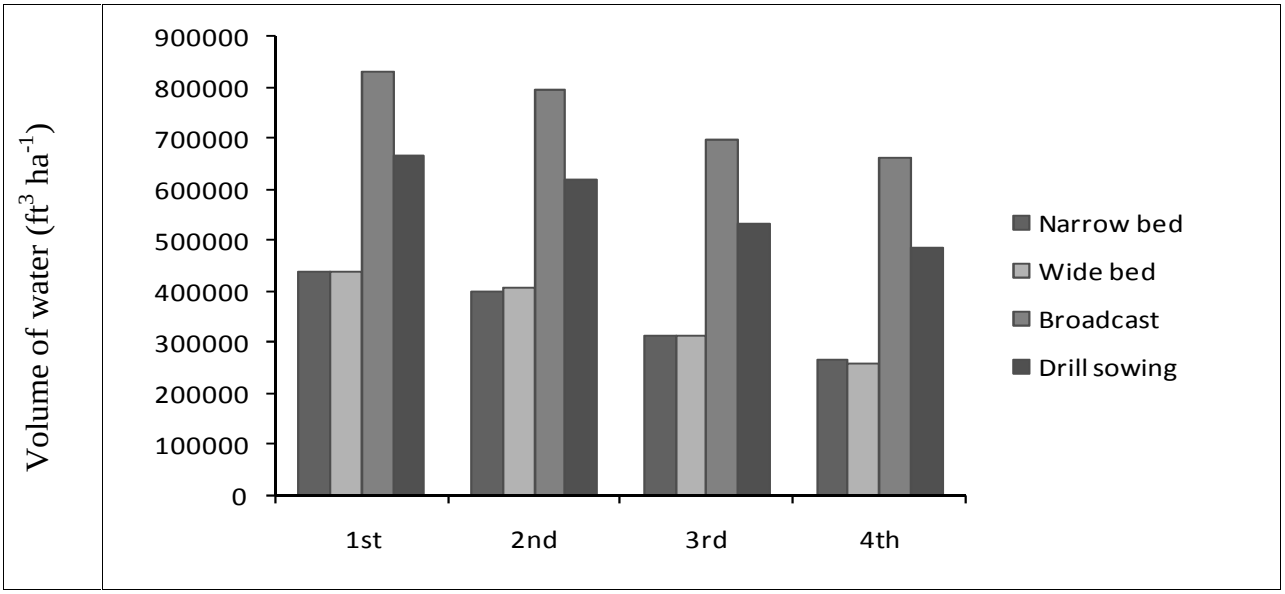
This study was conducted to manage residues of wheat and improve yield of cotton. Wheat was sown on 31-11-2017 by using hand drill. Experiment was laid out in completely randomized design having three replications. Fertilizer was applied at 120-90-62.5 NPK kg ha^{-1}. Plot size was 3 m × 6 m. All other agronomic practices were kept uniform.

When the wheat crop was harvested the residues of wheat were managed by four methods i.e T_1= residues removed completely, T_2= residue incorporated, T_3= residue burnt and T_4= residues remain in field. Cotton crop was sown in the plots having residues managed by above mentioned techniques using randomized complete block design having three replications. The effect of residue management by each technique will be recorded in terms of seed cotton yield and overall performance of cotton crop.

Title-84: OPTIMIZING BED PLANTING TECHNIQUE FOR SOWING OF WHEAT UNDER KHANEWAL CONDITIONS, ARS, KHANEWAL DURING RABI 2017-18

This study was conducted to evaluate the optimize bed planting of wheat to save water and improve wheat productivity. Wheat was sown with four methods Narrow beds (45 cm top + 30 cm furrows, 3 rows), Wide beds (60 cm top + 45 cm furrows, 4 rows), broadcast and drill. Experiment was laid out in completely randomized design having three replications. Fertilizer was applied at 120-90-62.5 NPK kg ha^{-1}. Plot size was 6 m × 10 m. All other agronomic practices were kept uniform. Experiment was sown on 31-11-2017.

Treatments	**Grain yield (kg ha^{-1})**
Narrow bed	5452 A
Wide bed	4639 B
Broadcast	4194 C
Drill sowing	4689 B
LSD for sowing methods at 0.05 = 348	



	Irrigation

Figure 6: Amount of water applied at each irrigation for each sowing method

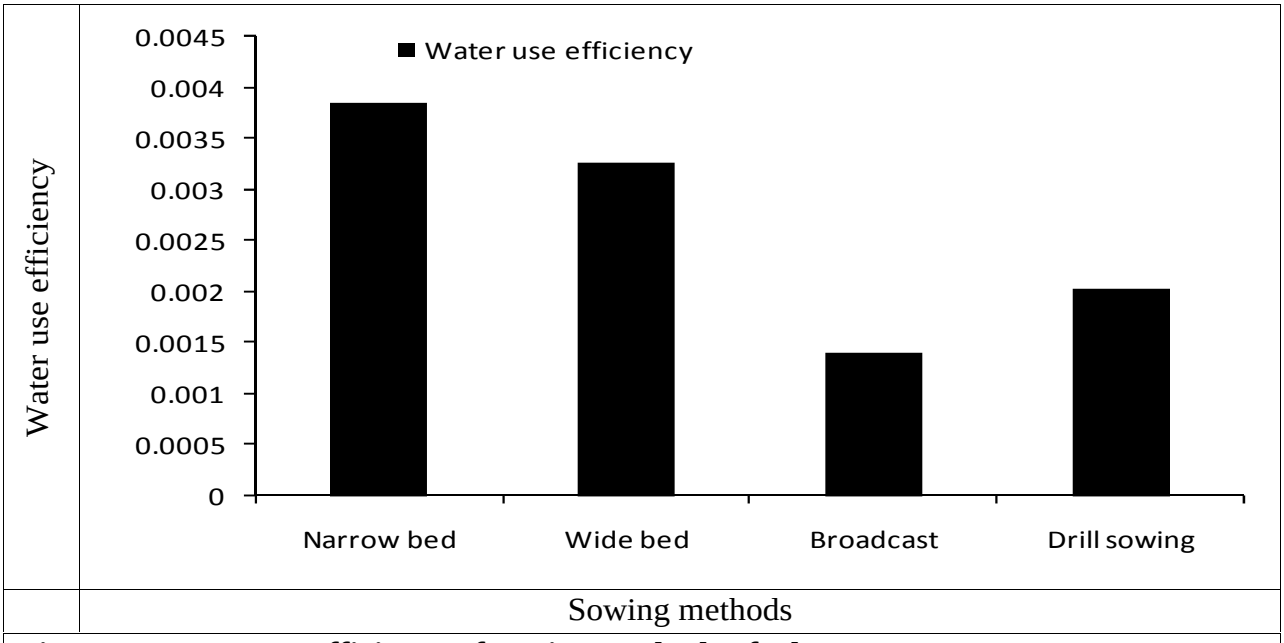


Figure 7: Water use efficiency of sowing methods of wheat

Results of this study revealed that maximum grain yield of 5452 kg ha^{-1} was recorded by wheat sowing with narrow bed planting technique. Followed by wide bed sowing and drill sowing i.e. 4639 and 4689 kg ha^{-1} respectively. While the lowest grain yield of 4194 kg ha^{-1} was recorded in broadcast method of sowing. Moreover least amount of water was required to irrigate the field sown with narrow bed planting and wide bed planting techniques as compared with broadcast and drill sowing. Similarly narrow bed planting gave more water use efficiency than other methods of wheat sowing

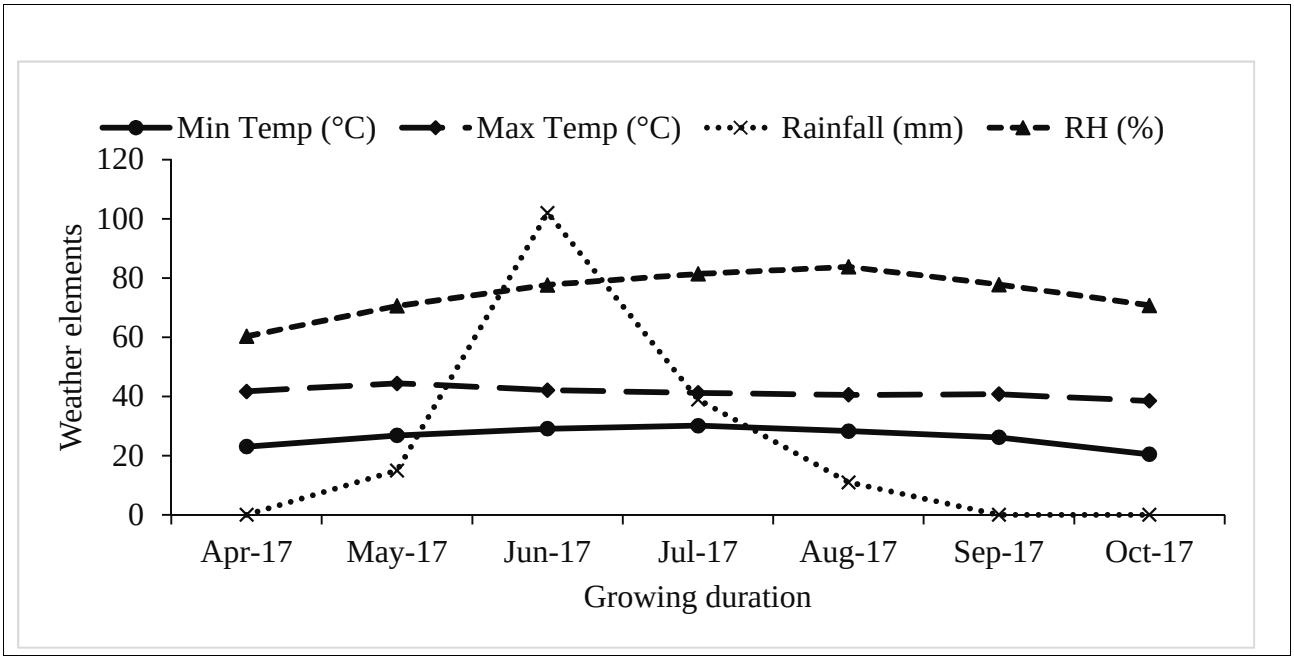
Hence it may be concluded that wheat may be sown to gain optimum yield and to enhance water use efficiency as well as to save the water.

BAHAWALPUR

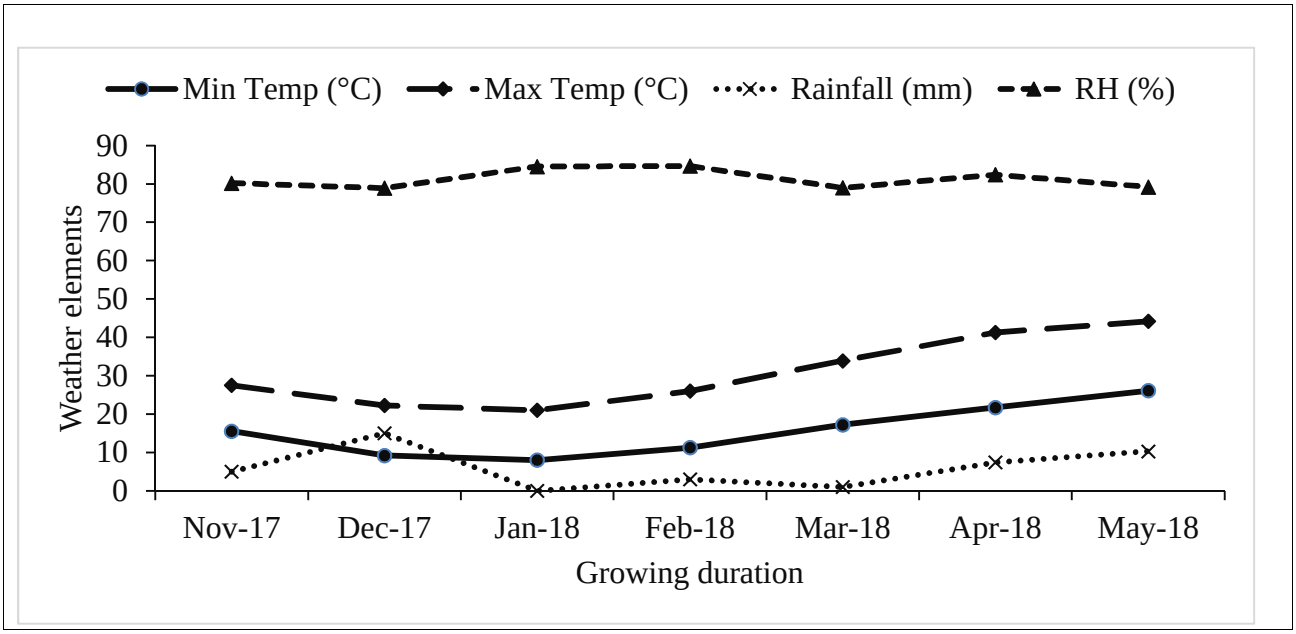
SEASON AND ITS EFFECTS

The weather remained almost dry during the season however, during Kharif 2017, rainfall was also recorded in some months. Weather elements recorded during growing seasons have been presented graphically.

Weather elements during kharif season 2017



Weather elements during rabi season 2017-18



Title-85: EFFICACY OF PRE AND POST EMERGENCE HERBICIDES IN COTTON

Weeds are chief constraints to accomplish potential in cotton crop. An experiment was conducted with objective to select the most appropriate pre and post emergence herbicide to control weeds population in cotton crop. The experimental site was Agronomic Research Station, Bahawalpur and experiment was conducted during summer (kharif) season 2017. The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated thrice. Treatments were comprised of different pre and post emergence weedicides viz. T_1 = Dual gold 2 L/ha (Pre-emergence); T_2 = Pendimethalin 3 L/ha (Pre-emergence); T_3 = Acetaclore 1000 mL/ha (Pre-emergence); T_4 = Phenoxafop-e-ethyl 1250 mL/ha (Post emergence for grasses); T_5 = Clodinofop450 g/ha (Post emergence for grasses); T_6 = Heloxyfop 1250 mL/ha (Post emergence for grasses) and T_7 = Control. Significantly more and statistically alike seed cotton yield was recorded with dual gold 2 L/ha (pre-emergence) (2827 kg ha^{-1}); and pendimethalin 3 L/ha (pre-emergence) (2818 kg ha^{-1}) compared to other treatments (Table 1).

Table: Effect of different herbicides on seed cotton yield

Treatments	Seed cotton yield (kg ha^{-1})
Dual gold 2 L/ha (Pre-emergence)	2827 A
Pendimethalin 3 L/ha (Pre-emergence)	2818 A
Acetaclore 1000 mL/ha (Pre-emergence)	2378 B
Phenoxafop-e-ethyl 1250 mL/ha (Post emergence for grasses)	2269 B
Clodinofop 450 g/ha (Post emergence for grasses)	2285 B
Heloxyfop 1250 mL/ha (Post emergence for grasses)	2251 B
Control	1797 C
Tukey's HSD	383.5

Title-86: GROWING OF ORGANIC COTTON

Continuous use of fertilizers and other synthetic substances pollute the environment. An experiment was conducted with the objective of determination of appropriate organic input for cotton and thus reduce the use fertilizer in cotton. The experiment was conducted at Agronomic Research Station, Bahawalpur during summer (kharif) season 2017. The experiment was conducted using Randomized Complete Block Design (RCBD) having three replications. Treatments were comprised of T_1 = FYM @ 5 t/ha; T_2 = Poultry waste @ 5 t/ha; T_3 = Press mud @ 5 t/ha; T_4= FYM @ 3.5 t/ha + Poultry waste @ 2.5 t/ha and T_5 = Control. Relatively more seed cotton yield was observed with poultry waste @ 5 t/ha (2290 kg ha^{-1}) compared to other treatments (Table 2).

Table: Effect of organic amendments on seed cotton yield

Treatments	Seed cotton yield (kg ha^{-1})
FYM @ 5 t/ha	1908 B
Poultry waste @ 5 t/ha	2290 A
Press mud @ 5 t/ha	1936 AB
FYM @ 3.5 t/ha + Poultry waste @ 2.5 t/ha	2249 AB
Control	1438 C
Tukey's HSD	354.6

Title-87: WEED MANAGEMENT IN MAIZE FODDER

Growth of weeds in maize is hampering the accomplishment of biomass yield potential in maize fodder. An experiment was conducted with objective to select the most efficient weedicide for maize fodder. The experiment was conducted at Agronomic Research Station, Bahawalpur during summer (kharif) season 2017. The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated thrice. Treatments were consisted of T_1 = Atrazine + Mestrione 1250 mL/ha (Post emergence); T_2 = Primextra gold 1000 mL/ha (Post emergence); T_3 = Pendimethalin 3 L/ha (Pre-emergence); T_4 = Atrazine 1250 mL/ha (Post emergence) and T_5 = Control. Significantly more and statistically alike green fodder yield was recorded with Atrazine + Mestrione 1250 mL/ha (Post emergence) (25842 kg ha^{-1}), Primextra gold 1000 mL/ha (Post emergence) (25368 kg ha^{-1}) and Atrazine 1250 mL/ha (Post emergence) (25708 kg ha^{-1}) compared to other treatments (Table 3).

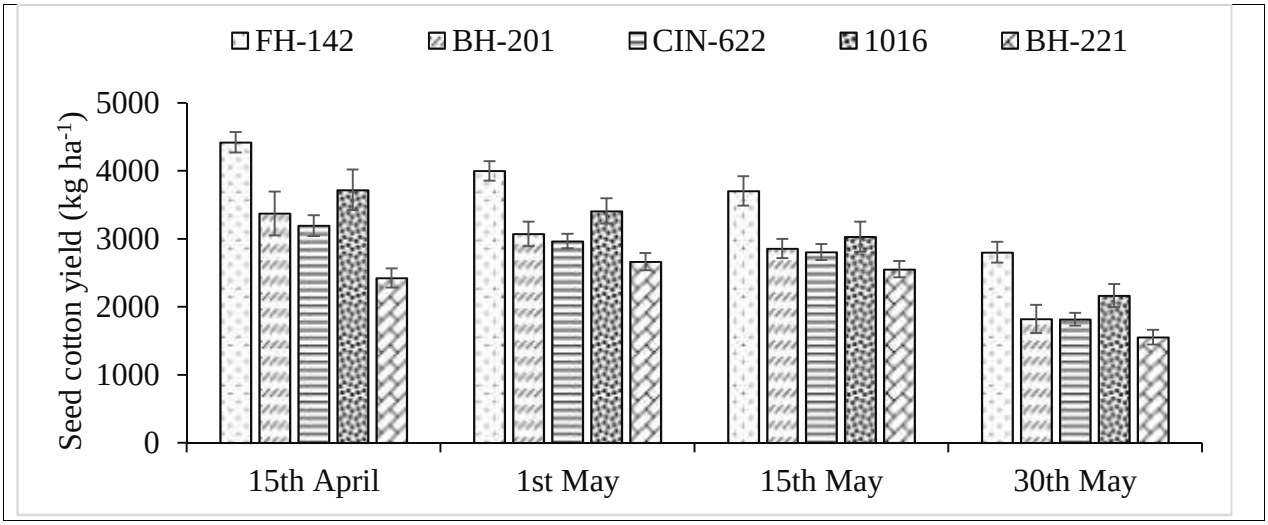
Table: Effect of weedicides on green fodder yield of maize

Treatments	Green fodder yield (kg ha^{-1})
Atrazine + Mestrione 1250 mL/ha (Post emergence)	25842 A
Primextra gold 1000 mL/ha (Post emergence)	25368 A
Pendimethalin 3 L/ha (Pre-emergence)	20714 B
Atrazine 1250 mL/ha (Post emergence)	25708 A
Control	12383 C
Tukey's HSD	4603.0

Title-88: PHENOLOGY OF DIFFERENT COTTON GENOTYPES UNDER DIFFERENT PLANTING DATES IN COTTON WHEAT CROPPING SYSTEM

Continuously rising temperature and varying climate often causes the failure of accomplishment of yield potential in numerous genotypes of cotton. An experiment was conducted with objective to select the most suitable genotypes under varying climatic conditions. The experiment was conducted at Agronomic Research Station, Bahawalpur during summer (kharif) season 2017. The experiment was performed in Randomized Complete Block Design (RCBD) with split treatments structure and replicated three times. Treatments were comprised of sowing dates in main plots viz. D_1 = 15th April; D_2 = 1st May; D_3 = 15th May and D_4 = 30th May while varieties in sub-plot viz. V_1 = FH-142; V_2 = BH-201; V_3 = CIM-622; V_4 = CIM-1016 and V_5 = BH-221. Seed cotton yield was significantly affected by varying sowing dates and genotypes; however, their interaction was non-significant. Comparatively more seed cotton yield was recorded with sowing on 15th April (3426 kg ha^{-1}) than other sowing dates. While, significantly more seed cotton yield was recorded with genotype 'FH-142' (3731 kg ha^{-1}) (Figure 1).

Figure: Effect of sowing dates and genotypes on seed cotton yield



Title-89: REARING OF EARTHWORMS FOR VERMI-COMPOST

Decreased availability of organic manures is problem for organic nutrition of crops. An experiment was conducted at Agronomic Research Station, Bahawalpur during summer (kharif) season 2017 to select the most appropriate species of earthworms for producing vermi-compost to apply in field crops. Treatments were comprised of S_1 = group A (Chilwa); S_2 = group B (Pakkah) and S_3 = Group C (Kaccha). The collection and rearing of earthworms is in progress (Figure 2).

Figure: Verm casts collected from different species of earthworms

Title-90: RESIDUE MANAGEMENT IN WHEAT-COTTON CROPPING SYSTEM

Residue management in wheat-cotton cropping system is a chief constraint that confines crop productivity. This study was aimed at finding the most suitable method to manage residues in cotton-wheat cropping system. The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated four times. The experimental treatments were T_1 = cotton planting after full wheat residue burning; T_2 = cotton planting after full wheat residue incorporation; T_3 = cotton planting after full wheat residue removed and T_4 = Cotton planting after full wheat residue left/retained. Significantly higher seed cotton yield (3287 kg ha^{-1}) was obtained with cotton planting after full wheat residue incorporation compared to other treatments (Table 4).

Table: Effect of residues management techniques on seed cotton yield

Treatments	Seed cotton yield (kg ha^{-1})
Cotton planting after full wheat residue burning	2850 B
Cotton planting after full wheat residue incorporation	3287 A
Cotton planting after full wheat residue removed	2762 B
Cotton planting after full wheat residue left/retained	2907 B
Tukey's HSD	360.8

Title-91: RELAY CROPPING OF BT COTTON IN WHEAT

Due to introduction of Bt cotton in cotton-wheat cropping system, the area under wheat is reducing which is threat to our national food security. The present study was designed to adjust the Bt cotton crop in standing wheat as relay crop. The experimental site was Agronomic Research Station, Bahawalpur and experiment was conducted during summer (kharif) season 2017. The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated thrice. The treatments were comprised of T_1 = wheat planted on ridge and alternate furrow closed for cotton planting on both sides of furrow (Row × Row = 75 cm); T_2 = Wheat planted on ridges and every 3rd furrow closed and cotton planting on both sides of furrow (Paired row of cotton after every 150 cm); T_3 = wheat planted on flat in 90 cm strips and 60 cm space after each strip for cotton dibbling (double row) (paired row of cotton after every 150 cm); T_4 = cotton after wheat and T_5 = Bt cotton alone (early). Significantly higher seed cotton yield was recorded with Bt cotton alone (early) (4780 kg ha^{-1}) compared to other treatments.

Table: Effect of relay cropping systems on seed cotton yield

Treatments	Seed cotton yield (kg ha^{-1})
Wheat planted on ridge and alternate furrow closed for cotton planting on both sides of furrow (Row × Row = 75 cm)	4239 B
Wheat planted on ridges and every 3rd furrow closed and cotton planting on both sides of furrow (Paired row of cotton after every 150 cm)	3759 C
Wheat planted on flat in 90 cm strips and 60 cm space after each strip for cotton dibbling (double row) (Paired row of cotton after every 150 cm)	4335 B
Cotton after wheat	2475 D
Bt cotton alone (early)	4780 A
Tukey's HSD	358.5

Title-92: MECHANICAL PLANTING OF COTTON

Conventional planting of cotton often enhances the cost of production of cotton. An experiment was conducted to study the feasibility of mechanization in cotton crop. The experimental site was Agronomic Research Station, Bahawalpur and experiment was conducted during summer (kharif) season 2017. The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated thrice. Treatments were comprised of P_1 = cotton planting on 75 cm apart beds with planter; P_2 = cotton planting on 75 cm apart beds (45 cm bed + 30 cm furrow) with manual dibbling; P_3 = cotton planting on 75 cm apart ridges with planter; P_4 =

cotton planting on 75 cm apart ridges with manual dibbling; P_5 = cotton planting on 75 cm apart beds with manual dibbling (check); P_6 = flat planting in 75 cm spaced rows by drill (check). Relatively higher seed cotton yield was recorded with 'cotton planting on 75 cm apart beds with manual dibbling (check)' (2769 kg ha^{-1}) compared to other treatments

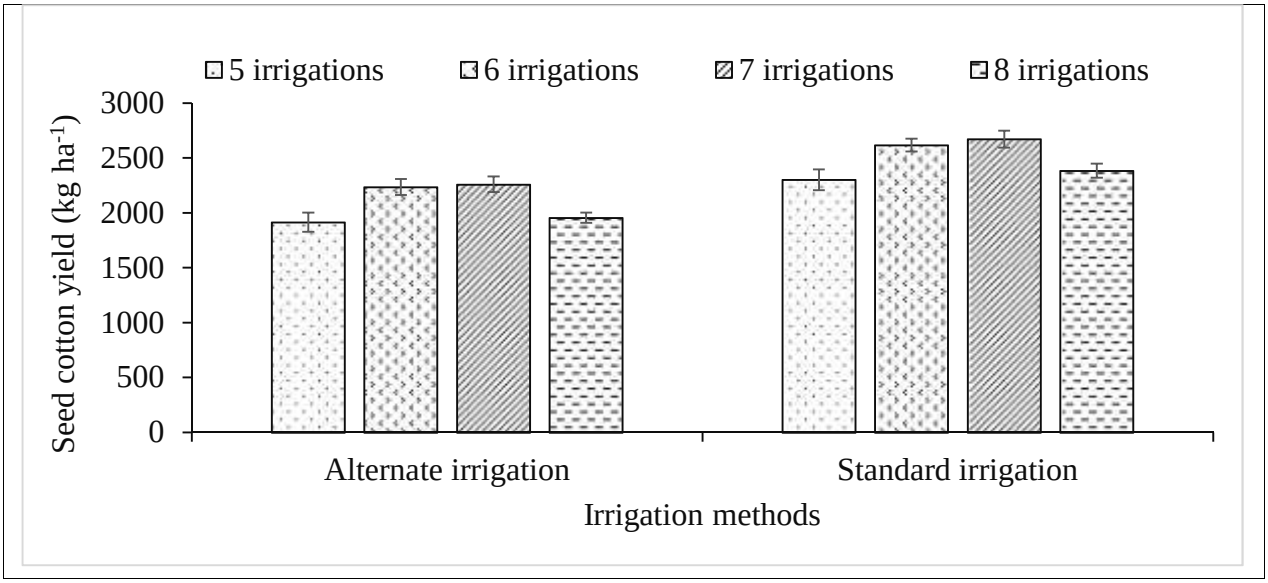
Table: Effect of mechanical methods on seed cotton yield

Treatments	**Seed cotton yield (kg ha^{-1})**
Cotton planting on 75 cm apart beds with planter	2311 B
Cotton planting on 75 cm apart beds (45 cm bed + 30 cm furrow) with manual dibbling	2748 A
Cotton planting on 75 cm apart ridges with planter	2359 B
Cotton planting on 75 cm apart ridges with manual dibbling	2724 A
Cotton planting on 75 cm apart beds with manual dibbling (check)	2769 A
Flat planting in 75 cm spaced rows by drill (check)	1868 C
Tukey's HSD	343.5

Title-93: EFFECT OF VARYING IRRIGATION FREQUENCIES ON SEED COTTON YIELD OF BT COTTON

Drought stress negatively impacts the productivity of cotton crop. An experiment was conducted with the objectives to determine the most suitable irrigation level and irrigation method. The experiment was conducted at Agronomic Research Station, Bahawalpur during summer (kharif) season 2017. The experiment was laid out in Randomized Complete Block Design (RCBD) under split arrangement and replicated thrice. The treatments
were comprised of two irrigation methods in main plot viz. M_1 = alternate furrow irrigation and M_2 = standard irrigation and 4 levels of irrigation in split plot viz. L_1 = 5 irrigations; L_2 = 6 irrigations; L_3= 7 irrigations and L_4 = 8 irrigations. Seed cotton yield was significantly affected by irrigation methods and levels however, their interaction was non-significant. Significantly higher seed cotton yield was obtained with standard irrigation (2493 kg ha^{-1}). Whereas, significantly more and statistically alike seed cotton yield was recorded with 6 (2426 kg ha^{-1}) and 7 (2466 kg ha^{-1}) irrigations

Figure 4: Effect of irrigation methods and frequencies on seed cotton yield



Title-94: WATER ECONOMY IN RELAY CROPPING OF COTTON IN STANDING WHEAT CROP

Water scarcity is chief constraint in crop production in prevailing scenario. The present study was aimed at conserving the water use in wheat crop using different relay cropping systems. The experimental site was Agronomic Research Station, Bahawalpur and experiment was conducted during winter (rabi) season 2017-18. The experiment was laid out under Randomized Complete Block Design (RCBD) and replicated three times. Treatments were comprised of different relay cropping systems viz. T_1 = Wheat planting on 75 cm apart ridges and alternate furrow closed for cotton planting; T_2 = Wheat planting on 75 cm apart ridges and every third furrow closed for cotton planting; T_3 = Wheat planting on 60 cm strips (90 cm) and cotton planting on furrows between strips and T_4 = Wheat after cotton (conventional). Relatively more grain yield was recorded for wheat after cotton (conventional) (4.05 t ha^{-1}) and it was statistically like wheat planting on 75 cm apart ridges and every third furrow closed for cotton planting (3.72 t ha^{-1}) and wheat planting on 60 cm strips (90 cm) and cotton planting on furrows between strips (3.76 t ha^{-1})

Table: Effect of relay cropping systems on grain yield of wheat

Treatments	Grain yield (t ha^{-1})
Wheat planting on 75 cm apart ridges and alternate furrow closed for cotton planting	3.49 B
Wheat planting on 75 cm apart ridges and every third furrow closed for cotton planting	3.72 AB
Wheat planting on 60 cm strips (90 cm) and cotton planting on furrows between strips	3.76 AB
Wheat after cotton (conventional)	4.05 A
Tukey's HSD	0.506

Title-95: RESIDUE MANAGEMENT IN WHEAT COTTON CROPPING SYSTEM

Residue is a main reason for late sowing of crops in cotton wheat cropping system. An experiment was conducted with the objective to manage residues in cotton wheat cropping system. The experiment was conducted at Agronomic Research Station, Bahawalpur during winter 2017-18. The experiment was laid out under Randomized Complete Block Design (RCBD) and treatments were repeated three times. Treatments were comprised of T_1 = Wheat residue incorporated and cotton planting on furrow beds; T_2 = Wheat residue incorporated + 60 kg ha^{-1} N added at incorporation and cotton planting on furrow beds; T_3 = Wheat residue incorporated + EM 10 L ha^{-1} added at rouni and cotton planting on furrow beds and T_4 = Cotton planting by new planter in standing wheat residue. Relatively more and statistically similar grain yield was obtained with 'wheat residue incorporated + 60 kg ha^{-1} N added at incorporation and cotton planting on furrow beds' (4.02 t ha^{-1}), 'wheat residue incorporated + EM 10 L ha^{-1} added at rouni and cotton planting on furrow beds' (3.63 t ha^{-1}) and 'cotton planting by new planter in standing wheat residue' (3.89 t ha^{-1})

Table: Effect of residue management systems on grain yield of wheat

Treatments	Grain yield (t ha^{-1})
Wheat residue incorporated and cotton planting on furrow beds	3.55 B
Wheat residue incorporated + 60 kg ha^{-1} N added at incorporation and cotton planting on furrow beds	4.02 A
Wheat residue incorporated + EM 10 L ha^{-1} added at rouni and cotton planting on furrow beds	3.63 AB
Cotton planting by new planter in standing wheat residue	3.89 AB
Tukey's HSD	0.463

Title-96: CONTROL OF WEEDS IN WHEAT IN COTTON ZONE (ZONAL TRIAL)

Weeds are major nuisance that hamper achievement of potential yield in wheat. An experiment was conducted to evaluate different herbicides to control weeds and keep weed population below economic threshold level. The experiment was conducted at Agronomic Research Station, Bahawalpur during winter season 2017-18. The experiment was laid out under Randomized Complete Block Design (RCBD) and replicated three times. Treatments were comprised of different herbicide viz. T_1 = Atlantic 3.6 WG (Mesosulfuron) @ 400 g ha^{-1} (Bayer Pakistan); T_2 = Findus 3.6 WG (Mesosulfuron + Iodosulfuron) @ 400 g ha^{-1} (Sun Crop); T_3 = Ferarry 16 EC (Fenoxaprop + Metribuzin) @ 750 mL ha^{-1} (Four Brothers); T_4 = Axial 050 EC (Penoxaden) @ 825 mL ha^{-1} (Syngenta Pakistan); T_5 = Topik 15 WP (Clodianfop propargyl) @ 300 g ha^{-1} (Syngenta Pakistan); T_6 = Sonak 15 WP (Clodianfop propargyl) @ 300 g ha^{-1} (Jaffar Agros); T_7 = Skype 20 EC (Clodianfop propargyl) @ 250 mL ha^{-1} (Tara group); T_8 = Certain plus 14.5 EC (Clodianfop + Fenoxaprop + Tralkoxydim) @ 1250 mL ha^{-1}; T_9 = Buctril super 60 EC (Bomoxynil + MCPA) @ 750 mL ha^{-1} (Bayer Pakistan); T_{10}= Selector 60 EC (Bomoxynil + MCPA) @ 750 mL ha^{-1} (Four Brothers); T_{11} = Bomoxynil + MCPA 40 EC @ 1250 mL ha^{-1} (generic companies); T_{12} = Starne-M 50 EC (Fluroxypyr + MCPA) @ 750 mL ha^{-1} (FMC); T_{13} = Harvester 100 + 400 g L^{-1} (Fluroxypyr + MCPA) @ 1000 mL ha^{-1} (Kanzo); T_{14} = Laren max 66.7 WG (Metsulfuron + Tribenuron) @ 20 g ha^{-1} (Syngenta Pakistan); T_{15} = Metafin Supper 28.6 WG (Metsulfuron + Tribenuron) @ 20 g ha^{-1} + @20 g ha^{-1} (Syngenta Pakistan) and T_{16} = Control. Relatively more grain yield was recorded with 'Atlantic 3.6 WG (Mesosulfuron) @ 400

g ha^{-1} (Bayer Pakistan)' (3.89 t ha^{-1}), 'Findus 3.6 WG (Mesosulfuron + Iodosulfuron) @ 400 g ha^{-1} (Sun Crop)' (4.11 t ha^{-1}), 'Ferarry 16 EC (Fenoxaprop + Metribuzin) @ 750 mL ha^{-1} (Four Brothers)' (3.74 t ha^{-1}) and 'Certain plus 14.5 EC (Clodianfop + Fenoxaprop + Tralkoxydim) @ 1250 mL ha^{-1}' (3.69 t ha^{-1}) compared to other herbicide treatments (Table 9).

Table: Effect of different herbicides on grain yield of wheat

Treatments	Grain yield (t ha^{-1})
Atlantic 3.6 WG (Mesosulfuron) @ 400 g ha^{-1} (Bayer Pakistan)	3.89 AB
Findus 3.6 WG (Mesosulfuron + Iodosulfuron) @ 400 g ha^{-1} (Sun Crop)	4.11 A
Ferarry 16 EC (Fenoxaprop + Metribuzin) @ 750 mL ha^{-1} (Four Brothers)	3.74 ABC
Axial 050 EC (Penoxaden) @ 825 mL ha^{-1} (Syngenta Pakistan)	3.55 ABCD
Topik 15 WP (Clodianfop propargyl) @ 300 g ha^{-1} (Syngenta Pakistan)	3.41 ABCDE
Sonak 15 WP (Clodianfop propargyl) @ 300 g ha^{-1} (Jaffar Agros)	3.21 BCDEF
Skype 20 EC (Clodianfop propargyl) @ 250 mL ha^{-1} (Tara group)	3.20 BCDEF
Certain plus 14.5 EC (Clodianfop + Fenoxaprop + Tralkoxydim) @ 1250 mL ha^{-1}	3.69 ABC
Buctril super 60 EC (Bomoxynil + MCPA) @ 750 mL ha^{-1} (Bayer Pakistan)	2.89 DEFG
Selector 60 EC (Bomoxynil + MCPA) @ 750 mL ha^{-1} (Four Brothers)	2.36 G
Bomoxynil + MCPA 40 EC @ 1250 mL ha^{-1} (generic companies)	2.70 EFG
Starne-M 50 EC (Fluroxypyr + MCPA) @ 750 mL ha^{-1} (FMC)	2.78 EFG
Harvester 100 + 400 g L^{-1} (Fluroxypyr + MCPA) @ 1000 mL ha^{-1} (Kanzo)	3.06 CDEFG
Laren max 66.7 WG (Metsulfuron + Tribenuron) @ 20 g ha^{-1} (Syngenta Pakistan)	2.63 FG
Metafin Supper 28.6 WG (Metsulfuron + Tribenuron) @ 20 g ha^{-1} + @20 g ha^{-1} (Syngenta Pakistan)	2.59 FG
Control	2.49 FG
Tukey's HSD	0.744

Title-97: OAT FODDER YIELD ENHANCEMENT UNDER DIFFERENT METHODS OF PLANTING

Optimization of sowing method in oat fodder is prerequisite to attain potential of green fodder yield. The present experiment was aimed at enhancing green fodder yield by optimizing sowing method. The experiment was conducted at Agronomic Research Station, Bahawalpur during winter season 2017-18. The experiment was laid out under Randomized Complete Block Design (RCBD) and replicated four times. Treatments were comprised of different sowing methods viz. T_1 = Broadcast (Conv.) in flat field; T_2 = Broadcast of seed and augmented with furrows (Ridging); T_3 = Bed planting (90 cm apart beds with two rows) and T_4 = Bed planting (90 cm apart beds with three rows). Comparatively higher and statistically similar green fodder yield was observed for 'Broadcast of seed and augmented with furrows (Ridging)' (53.68 t ha^{-1}), 'Bed planting (90 cm apart beds with two rows)' (47.49 t ha^{-1}) and 'Bed planting (90 cm apart beds with three rows)' (50.98 t ha^{-1}) compared to other treatments

Table: Effect of sowing methods on green fodder yield of oat

Treatments	Green fodder yield ($t\ ha^{-1}$)
Broadcast (Conv.) in flat field	43.27 B
Broadcast of seed and augmented with furrows (Ridging)	53.68 A
Bed planting (90 cm apart beds with two rows)	47.49 AB
Bed planting (90 cm apart beds with three rows)	50.98 A
Tukey's HSD	7.676

Title-98: YIELD POTENTIAL OF RAYA VARIETIES UNDER DIFFERENT METHODS OF PLANTING

Selection of appropriate genotype and sowing method enhance seed yield in raya. An experiment was conducted with objectives to select appropriate variety and optimize sowing method in raya. The experiment was conducted at Agronomic Research Station, Bahawalpur during winter season 2017-18. The experiment was laid out under Randomized Complete Block Design (RCBD) in split arrangement and replicated thrice. Treatments were comprised of sowing methods in main plots viz. P_1 = Broadcast (conventional); P_2 = Drill sowing and P_3 = Broadcast of seed and augmented with furrows (ridging) and varieties in sub plots viz. V_1 = Super raya and V_2 = Khanpurraya. Sowing methods different significantly from each other for seed yield. While, varieties and interaction of sowing methods and varieties did not differ significantly for seed yield. Relatively more and statistically alike seed yield was recorded with 'Drill sowing' (2.14 t ha^{-1}) and 'Broadcast of seed and augmented with furrows (ridging)' (2.35 t ha^{-1}) over two genotypes

Table: Effect of sowing methods and varieties on seed yield of raya

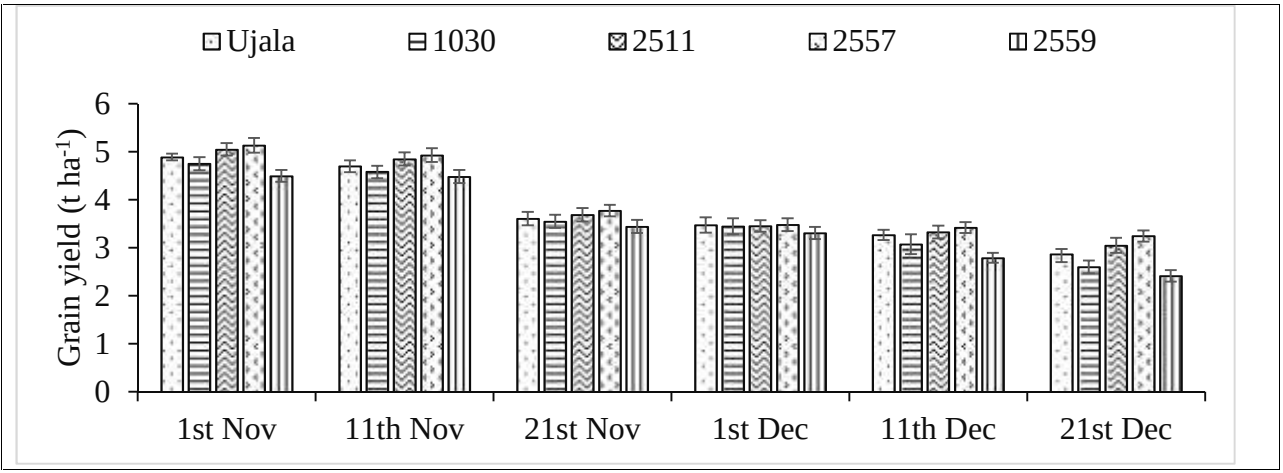
Varieties	Planting methods			Varieties ($t\ ha^{-1}$)
	Broadcast (conventional)	Drill sowing	Broadcast of seed and augmented with furrows (ridging)	
S. raya	1.96	2.12	2.35	2.15
K. raya	2.05	2.16	2.36	2.19
Planting methods	2.00 B	2.14 AB	2.35 A	
Tukey's HSD for planting methods				0.325

Title-99: ADAPTATION OF ADVANCED WHEAT LINES TO VARIOUS PLANTING DATES UNDER BAHAWALPUR CONDITIONS

Selection of suitable genotypes and optimization of sowing date are vital to achieve potential of grain yield in wheat. An experiment was performed with objectives to select an appropriate genotypes and sowing date to improve productivity of wheat crop. The experiment was conducted at Agronomic Research Station, Bahawalpur during winter season 2017-18. The experiment was laid out under Randomized Complete Block Design (RCBD) in split arrangement and replicated three times. Treatments were comprised of sowing dates in main plots viz. D_1 = 1st November, D_2 =11th November; D_3 = 21st November, D_4 = 1st December, D_5 =

11^{th} December and D_6 = 21^{st} December and genotypes in sub plots viz. V_1 = Ujala; V_2 = 1030; V_3 = 2511; V_4 = 2557 and V_5 = 2559. Sowing dates and varieties significantly differed for grain yield while sowing dates × varieties effect was non-significant. Significantly more and statistically similar grain yield was quantified with '1^{st} November' (4.86 t ha^{-1}) and '11^{th} November' (4.70 t ha^{-1}) compared to other sowing dates. Whereas, significantly more and statistically alike grain yield was recorded for genotypes '2557' (4.00 t ha^{-1}), '2511' (3.90 t ha^{-1}) and 'Ujala' (3.80 t ha^{-1}) compared to other genotypes

Figure: Effect of sowing dates and varieties grain yield of wheat



Title-100: WATER USE EFFICIENCY IN WHEAT BY LASER GRADING UNDER DIFFERENT METHODS OF PLANTING

Water scarcity has been a continual threat for crop production. An experiment was conducted with the objective to improve water use efficiency in wheat using LASER and sowing methods as tools. The experiment was conducted at Agronomic Research Station, Bahawalpur during winter season 2017-18. The experiment was laid out under Randomized Complete Block Design (RCBD) in split arrangement and replicated three times. Treatments were comprised of LASER levelling in main plots viz. L_1 = Normal LASER and L_2 = Graded LASER and sowing methods in sub plots viz. S_1 = Rabi drill (Conv.) in flat field; S_2 = Broadcast of seed and augmented with furrows (ridging) and S_3 = Bed planting (90cm apart beds with three rows). LASER levelling treatments and interaction were non-significant while different sowing methods varied significantly from each other for grain yield. Statistically similar and significantly higher grain yield was recorded for 'Broadcast of seed and augmented with furrows (ridging)' (4.15 t ha^{-1}) and 'Bed planting (90cm apart beds with three rows)' (4.01 t ha^{-1}) compared to other sowing methods

Table: Effect of LASER leveling and sowing methods on grain yield of wheat

Sowing methods	LASER levelling		Sowing methods (t ha^{-1})
	Normal LASER	Graded LASER	
Rabi drill (Conv.) in flat field; and	3.55	3.60	3.58 B
Broadcast of seed and augmented with furrows (ridging)	4.03	4.26	4.15 A

Bed planting (90cm apart beds with three rows)	4.00	4.02	4.01 AB
LASER levelling (t ha^{-1})	3.86	3.96	
Tukey's HSD for sowing methods			0.445

Title-101: GROWING OF ORGANIC WHEAT

Excessive use of synthetic fertilizers enhances cost of production of wheat. An experiment was conducted with the objective to determine most suitable organic amendment for wheat. The experiment was conducted at Agronomic Research Station, Bahawalpur during winter season 2017-18. The experiment was laid out under Randomized Complete Block Design (RCBD) and replicated three times. Treatments were comprised of different organic amendments viz. T_1 = FYM @ 15 t ha^{-1}; T_2 = Press mud @ 10 t ha^{-1}; T_3 = FYM @ 10 t ha^{-1} + press mud @ 5 t ha^{-1} and T_4 = Control. Relatively more grain yield was recorded with 'Press mud @ 10 t ha^{-1}' (3.93 t ha^{-1}) and 'FYM @ 10 t ha^{-1} + press mud @5 t ha^{-1}' (4.05 t ha^{-1}) compared to other treatments

Table: Effect of organic amendments on grain yield of wheat

Treatments	**Grain yield (t ha^{-1})**
FYM @ 15 t ha^{-1}	3.64 AB
Press mud @ 10 t ha^{-1};	3.93 AB
FYM @ 10 t ha^{-1} + press mud @ 5 t ha^{-1} and	4.05 A
Control	3.26 B
Tukey's HSD	0.731

Title-102: REARING OF EARTHWORMS FOR VERMI-COMPOST

Decreased availability of organic manures is problem for organic nutrition of crops. An experiment was conducted at Agronomic Research Station, Bahawalpur during winter (rabi) season 2017-18 to select the most appropriate species of earthworms for producing vermi-compost to apply in field crops. Treatments were comprised of S_1 = group A (Chilwa); S_2 = group B (Pakkah) and S_3 = Group C (Kaccha). The collection and rearing of earthworms is in progress

Figure : Verm casts collected from different species of earthworms

KAROR

Title-103: PROVINCIAL COTTON COORDINATED TRIAL BT (PCCT-I)

This experiment was conducted to find out the best suited high yielding BT Cotton variety/line for sandy loam soil of Thal irrigated area. This trial was conducted in collaboration with Cotton Research Institute, Faisalabad. Forty cotton varieties/lines i.e. PC1-PC40 were tested under Thal irrigated conditions. The experiment was sown on 09-05-2017 in RCBD with three replications and Plot size of 3.0 m × 4.5 m with line to line distance 0.75 m. Chemical fertilizer @ 200-115-95 NPK kg ha^{-1} in the form of DAP, Urea and SOP was applied. The all other agronomic practices were kept normal and uniform. The cotton crop was picked on 19-10-2017 and 08-12-2017. The experiment was sown through hand drill and plant to plant distance was maintained after thinning.

The results showed that maximum seed cotton yield (4568 kg ha^{-1}) was obtained from NIAB-1011/48 followed by NIAB-545 (4197 kg ha^{-1}) and NIAB-898 (4074 kg ha^{-1}). The Minimum seed cotton yield of 1358 kg ha^{-1} was obtained from variety/line IR-NIBGE-10.

Title-104: PROVINCIAL COTTON COORDINATED TRIAL (PCCT-II)

This experiment was conducted to find out the best suited high yielding BT Cotton variety/line for sandy loam soil of Thal irrigated area. This trial was conducted in association with Cotton Research Institute, Faisalabad. Four cotton varieties/lines i.e. PC1-PC4 were tested under Thal irrigated conditions. The experiment was sown on 09-05-2017 in RCBD with three replications and Plot size of 3.0 m × 4.5 m with line to line distance 0.75 m. Chemical fertilizer @ 200-115-95 NPK kg ha^{-1} in the form of DAP, Urea and SOP was applied. The all other agronomic practices were kept normal and uniform. The cotton crop was picked 19-10-2017 and 08-12-2017. The experiment was sown through hand drill and plant to plant distance was maintained after thinning.

The results showed that maximum seed cotton yield (3259 kg ha^{-1}) was obtained from TIPU-2 which was statistically at par with FH-942* (2346 kg ha^{-1}). The Minimum seed cotton yield of 1975 kg ha^{-1} was obtained from variety/line THAKAR-2014and NIAB-444.

Table: Seed cotton yield of experiment PCCT-I

STRAINS	Seed Cotton Yield (kg ha^{-1})	STRAINS	Seed Cotton Yield (kg ha^{-1})
SLH-6	3383 bcdefgh	WEAL AG-5	2963 efghijk
SLH-19	3210 cdefghi	WEAL AG-6	3087 defghij
SITARA-15	4000 abc	SAHARA-2026	1852 lmn
SITARA-16	3210 cdefghi	NU-21	2839 fghijk
THAKAR-808	3086 defghij	BH-201	2840 fghijk
NS-181	2642 hijkl	BH-221	3333 bcdefghi
NS-191	2716 ghijkl	VH-189	3333 bcdefghi
NIAB-545	4197 ab	VH-383	2222 jklmn
NIAB-1011/48	4568 a	VH-GULZAR	1605 mn
NIAB-898	4074 abc	BAHAR-07	3333 bcdefghi
AA-933	2716 ghijkl	BAHAR-2017	3210 cdefghi
FH-152	3210 cdefghi	FH-142 *	2469 ijklm
FH-444	3704 abcdef	IR-NIBGE-9	2099 klmn
FH-490	3210 cdefghi	IR-NIBGE-10	1358 n
RH-662	3334 bcdefghi	CYTO-313	3457 bcdefgh
RH-668	3457 bcdefgh	CIM-632	3580 bcdefg
RH-AFNAN	2469 ijklm	TIPU-1	2222 jklmn
RH-MANTHAR	2716 ghijkl	TIPU-9	2593 hijkl
AGC-NAZEER-1	2963 efghijk	SHAHEEN-1	3950 abcd
WEAL AG-1606	2469 ijklm	FH-342	3827 abcde
LSD $_{5\%}$ = 886.89			

Table: Seed cotton yield of experiment PCCT-II

STRAINS	Seed Cotton Yield (kg ha^{-1})
THAKAR-2014	1975.0 b
NIAB-444	1975.0 b
FH-942*	2346.0 ab
TIPU-2	3259.0 a
LSD 5%	1028.6

Title-105: EFFECT OF VARIOUS PLANT POPULATIONS ON GROWTH AND YIELD OF CULTIVARS OF COTTON UNDER SANDY LOAM SOILS OF THAL

A field study was conducted to find out optimum plant population of cotton to get maximum seed cotton yield under Thal irrigated condition. The experiment was laid out in

randomized complete block design with four replication having net plot size of 4.5 m × 8 m. Three planting density i.e. 88925 plants ha^{-1} (15 cm), 60747 plants ha^{-1} (22.5 cm) and 44462 plants ha^{-1} (30 cm) were maintained by thinning 35 days after sowing. The cotton variety IUB-13 was sown with single row hand drill by maintaining 75 cm row spacing. All other agronomic and plant protection practices will be kept normal and uniform. The trial was picked on 19-10-2017 and 20-11-2017

The data presented in table given below showed that maximum value of seed cotton yield was observed in plots where plant density was 88925 plants ha^{-1} with 15 cm plant spacing for year 2016 and 2017 followed by 60747 plants ha^{-1} with 22.5 cm plant spacing. The minimum value of seed cotton yield was received from 44462 plants ha^{-1} with 30 cm plant spacing.

Table: Effect of plant population on yield of cotton

Plant Population	**Seed Cotton Yield kg ha^{-1}**	
	2016	**2017**
88925 plants ha^{-1} (15 cm)	1832 a	4009 a
60747 plants ha^{-1} (22.5 cm)	1756 b	3889 ab
44462 plants ha^{-1} (30 cm)	1682 c	3489 b
LSD value at 0.05%	12.149	455.06

Title-106: OPTIMIZING PLANTING TIME FOR DIFFERENT GENOTYPES OF PEARL MILLET

Suitable genotype and optimum planting time are the important component of production package for any crop. These management options are the precursor for good yield. Hence an experiment was conducted to find out suitable genotype of pearl millet and it performance at different planting time. Different six planting times (2^{nd} week of June to last week of September with 20 days interval) were kept in main plot while three genotypes of millet (88M86, 86M88, Maharaja) were randomized in sub plot in split plot design. The results revealed that pearl millet hybrid 86M88 performed good during last week of June and 2^{nd} week of July and gave grain yields 4494 kg ha^{-1} and 4014 kg ha^{-1}, respectively.

Table: Optimizing planting time for different genotypes of pearl millet under irrigated conditions

SOWING DATE	Pearl millet genotypes			
	86 M 66	**86 M 88**	**Maharaja**	**Mean**
2nd week of June	2543 D	3382 B	1752 EF	2559.3
Last week of June	3289 B	**4494 A**	3061 BC	3614.8
2nd week of July	3492 B	**4014 A**	1866 E	3124.0
Last week of July	2545 D	2780 CD	1187 G	2170.8
2nd week of August	1284 FG	1160 GH	666 HI	1036.7
Last week of August	555 I	629 I	321 I	501.6
Mean	2284.7	2743.3	1475.6	

Title-107: MICRO SEED YIELD TRIAL RAPESEED (*B. NAPUS*)

The trial was conducted to find out best suited strains of Rapeseed for Thal irrigated area, in collaboration with Oilseeds Research Institute, Faisalabad. Nine Rapeseed strains were tested at Agronomic Research Station Karor, during Rabi, 2017-18. The layout was Randomized Complete Block Design with three replications having net plot size 1.8 m × 5 m. The row and plant spacing were kept 45 cm and 15 cm respectively. A uniform N-P-K dose of 90-85-60 kg ha^{-1} was applied at the time of sowing during whole growth period. The results showed that maximum yield (3207 kg ha^{-1}) was obtained from strain KN-279, followed by KN-294(2092 kg ha^{-1}).

Table: Yield data of Micro seed trial of Rapeseed (*B. napus*)

Sr. No	Strains	Yield (kg ha^{-1})
1	RBN-13015	2159 def
2	RBN-13016	2555 bc
3	RBN-13017	2333 cde
4	RBN-13022	2363 cde
5	KN-279	3207 a
6	KN-294	2844 b
7	15CBN-006	1889 f
8	15CBN-010	2096 ef
9	Faisal Canola	2414 cd
LSD Value at 5%: 308.3		

Title-108: MICRO YIELD TRIAL MUSTARD

This trial was conducted with an objective to screen out best suited variety/line of Mustard for Thal irrigated area. The field study was conducted in collaboration with Oilseeds Research Institute, Faisalabad. Nine mustard varieties/ strains were sown on 12th of October at Agronomic Research Station Karor, during Rabi, 2017-18 in Randomized Complete Block Design. The experiment having plot size 1.80 m × 5.00 m was spaced 45 in rows. The fertilizer (N-P-K) at the rate of 90-85-60 kg ha^{-1} was applied. All P and K and 1/3rd of N were applied as basal dose while the remaining 2/3rd of N was applied in two equal splits at flowering and pod formation stage. The experiment was sown with hand drill and 15 cm plant to plant distance was maintained after thinning. This trial was harvested on 19th March 2018. All other agronomic and plant protection practices were kept normal and uniform.

The data given in below table illustrated that the strain KJ-238 gave maximum seed yield of 3996 kg ha^{-1} followed by Super Raya which produced grain yield of 3207 kg ha^{-1}. The date in above table showed that only single strain gave higher yield than check variety. The Minimum seed yield of 1492 kg ha^{-1} was received from RBJ-140

Table: Yield data of Mustard

Sr. No	Strains	Yield (kg ha^{-1})
1	RBJ-14012	1785 de
2	RBJ-15016	1959 d
3	RBJ-14011	1492 e
4	RBJ-15786	1948 d
5	KJ-244	2611 c
6	KJ-238	3996 a
7	BRJ-1405	2466 c
8	BRJ-1451	2440 c
9	Super Raya	3207 b
LSD Value at 5%: 313.21		

Title-109: DRY PEAS MICRO YIELD TRIAL

The research trial was carried out in collaboration with Pulses Research Institute; Faisalabad to find out best suited variety/line of dry peas for Thal irrigated conditions. Twelve Peas entries were sown at Agronomic Research Station, Karor in RCBD with three replications having plot size 1.20 m x 4.00 m. The grain yield data is given in Table 7.

Table: Yield of Dry Peas under Thal conditions

Sr. No	Strains	Yield kg ha^{-1}
1	DP-01-15	167 de
2	DP-02-15	242 cd
3	DP-03-15	272 c

4	DP-04-15	240 cd
5	DP-05-15	430 b
6	DP-10-15	386 b
7	DP-11-15	283 c
8	DP-12-15	103 e
9	DP-13-15	368 b
10	DP-14-15	515 a
11	NO.267 (C)	163 e
12	Climax (C)	115 e
LSD 0.05 = 76.158		

The higher grain yield of kg ha-1 360 was produced by line number 10 i.e. DP-14-15 followed by line number 5 (DP-05-15), 6 (DP-10-15) and 9 (DP-13-15) as shown in above table. The line number 08 (DP-12-15) gave lowest grain yield of 103 kg ha-1 which is statistically at par with line number 11 {NO.267 (C)} and {12 Climax (C}.

Title-110: CHICKPEA (KABULI) COOPERATIVE YIELD TRIAL

The trial was conducted in collaboration with Pulses Research Institute, Faisalabad to select best suited strains of chickpea under Thal irrigated area. Eighteen Chickpea strains (coop-1 to coop-18) were sown on 13th of October 2018 in randomized complete block design with three replications having plot size 1.2 m × 4 m at Agronomic Research Station, Karor – Layyah. The experiment was sown with hand drill by maintaining 30 cm row spacing. All other agronomic and plant protection practices were kept normal and uniform. The trial was harvested 17th of April.

Table: Yield data of chickpea (Kabuli) sown under rainfed conditions

Strains	Yield (kg ha-1)	Strains	Yield (kg ha-1)
Coop-1	1701 de	Coop-10	2430 bc
Coop-2	2590 bc	Coop-11	2430 bc
Coop-3	2062 cde	Coop-12	2896 ab
Coop-4	2437 bc	Coop-13	3287 a
Coop-5	2382 bc	Coop-14	1604 e
Coop-6	2909 ab	Coop-15	2277 c
Coop-7	2312 c	Coop-16	2222 cd
Coop-8	2278 c	Coop-17	2159 cde
Coop-9	2375 bc	Coop-18	2111 cde
LSD value at 5%: 576.02			

The above given results illuminated that maximum grain yield of 3287 kg ha^{-1} was received from line No. 13 followed by line No. 12, which produced grain yield 2896 kg ha^{-1}. The Minimum chickpea grain yield (1604 kg ha^{-1}) was produced by line 1

Title-111: CHICKPEA COOPERATIVE YIELD TRIAL (D)

The trial was conducted in collaboration with Pulses Research Institute, Faisalabad, to screen out best suited variety/line for Thal irrigated area. Twenty-four chickpea strains i.e. A-X were sown on 31th of October at Agronomic Research Station, Karor – Layyah. The layout was RCBD with three replications having plot size 1.2 m × 4 m. The experiment was sown with hand drill by maintaining 30, 10 cm row and plant spacing. All other agronomic and plant protection practices were kept normal and uniform. This experiment was harvested on 16th of April 2018. The grain yield data is given in Table 9:

Table: Yield data of Chickpea (Desi)

Strains	Yield (kg ha^{-1})	Strains	Yield (kg ha^{-1})
A	1552 g	M	3729 a
B	2403 cde	N	2555 bcd
C	2326 def	O	2861 bcd
D	3014 bc	P	1911 efg
E	2465 bcde	Q	2809 bcd
F	2680 bcd	R	1694 fg
G	2486 bcde	S	2802 bcd
H	2569 bcd	T	2819 bcd
I	2486 bcde	U	2465 bcde
J	2663 bcd	V	2792 bcd
K	2326 def	W	2472 bcde
L	3080 b	X	2896 bcd
LSD value at 5%: =642.93			

The data provided in above table revealed that maximum grain yield of 3729 kg ha^{-1} was received from line No. 13 (M) followed by line No. 12 (L) which produced grain yield of 3080 kg ha^{-1}. The Minimum grain yield of 1552 kg ha^{-1} was produced by line 01 (A).

Title-112: RESPONSE OF WHEAT TO DIFFERENT PLANTING METHODS UNDER ARID ENVIRONMENT

The experiment with the objective to find out the best sowing methods to get optimum yield of wheat under Thal irrigated conditions was laid out in randomized complete block design (RCBD) with four replications and having a net plot size of 10 m x 9.6 m. Wheat variety Jauher-2016 was sown with four planting methods i.e. Broadcasting, broadcasting with augmented drill

sowing and Zero Tillage. The N-P-K was applied at the rate of 130-115-62 kg ha-1. All other agronomic and plant protection practices were kept normal and uniform. The crop was harvested on 26th of April 2018 and the yield data is given as under.

Table: Grain yield of wheat as affected by different planting methods

Sowing Methods	Grain yield (kg ha^{-1})	
	2016-17	2017-18
Zero tillage	4310 c	4525
Drill sowing	4753 b	5159
Broadcasting with augmented furrow	5287 a	4921
Broadcasting	4870 b	4959
LSD $_{0.05}$	142.94	NS

The results from the above table showed that the higher grain yield of 5287 kg ha-1was produced where wheat was sown by broadcasting with augmented furrow in 2016-17 followed by broadcasting and drill sowing producing 4870 and 4753 kg ha-1 grain yield respectively. The zero till wheat sown produced minimum grain yield of 4310 kg ha-1. However, no significant difference was observed among four sowing methods in 2017-18 in respect of grain yield.

Title-113: EFFECT OF DIFFERENT SOWING DATES ON NEW WHEAT GENOTYPES UNDER THAL IRRIGATED CONDITIONS

The experiment with an objective to find out optimum sowing date of newly evolved wheat varieties under Thal irrigated conditions for maximum grain yield was laid out in RCBD in split plot arrangements with three replications. The sowing dates were kept in main plots while strains were kept in sub plots by maintaining a net plot size of 1.8 m × 6 m. The five wheat strains i.e. Anaaj 2017, TWS-12245, TWS- 12464, Galaxy-2013 and Ujala 2016 was sown with 15 days interval starting from first week of November to last week of December. The study was conducted on sandy loam soil. Fertilizer was applied at the rate of 130-115-62 N-P-K kg ha^{-1} in the form of Urea, Diammonium phosphate and Sulphate of potash, respectively. Whole phosphorus & potash and 1/3rd of nitrogen will be applied at the time of sowing. Remaining nitrogen will be applied in three equal splits with 1st, 2nd and 3rd irrigation. All other agronomic practices will be kept uniform. The experiment was harvested on 27th of April 2018. The grain yield data is given in Table 11.

Table: Yield of different wheat genotypes at different planting time

Varieties	Sowing Date					
	06-11-17	20-11-17	30-11-17	15-12-17	30-12-17	Mean
Anaaj-2017	4383 cde	5093 ab	4290 cdefg	3549 hi	3457 hi	4154
TWS-12245	3920 efghi	5062 ab	4722 bc	3704 ghi	3364 hi	4154
TWS-12464	4259 cdefg	5463 a	4691 bc	3673 ghi	3673 ghi	4352
Glaxy-2013	4352 cdef	5123 ab	4691 bc	3981 defgh	3735 fghi	4377

Ujala-2016	4599 bcd	5185 ab	4815 bc	3704 ghi	3302 i	4321
Mean	4302 bc	5185 a	4642 ab	3722 c	3506 c	
LSD 5%: Sowing date = 804.7, Varieties = ns, Interaction = 634.7						

The results from the above table showed that the higher grain yield of 5185 kg ha^{-1} was received when wheat was sown 20th of November which was statistically at par with 30th of November. The crop sown on 06th of November was lodged and produced less yield 4302 kg ha^{-1} as compared 20th and 30th of November. The minimum grain yield of 3506 kg ha^{-1} was produced when wheat was sown on 30th of December which was statistically at par with 15th of December. The data also depicted that no significant among all wheat strains/varieties was observed.

Title-114: EFFECT OF TEMPORAL VARIABILITY ON YIELD OF WHEAT CULTIVARS

The experiment with an objective to find out high yielding wheat strain/variety under varying sowing dates under Thal irrigated conditions. The experiment was laid out in RCBD in split plot arrangements with three replications. The sowing dates were kept in main plots while strains were kept in sub plots by maintaining a net plot size of 1.35 m × 6 m. The eight wheat strains i.e. Chakwal-50, Faisalabad-2008, Johar-2016, Roshan-17 and four coded strains from wheat Research Institute, Faisalabad were sown 15th and 30th of November. The study was conducted on sandy loam soil. Fertilizer was applied at the rate of 130-115-62 N-P-K kg ha^{-1} in the form of Urea, Diammonium phosphate and Sulphate of potash, respectively. Whole phosphorus & potash and 1/3rd of nitrogen will be applied at the time of sowing. Remaining nitrogen will be applied in three equal splits with 1st, 2nd and 3rd irrigation. All other agronomic practices will be kept uniform. The experiment was harvested on 28th of April 2018.

The results from the above table showed that the higher grain yield of 5175 kg ha^{-1} was produced by coded strain i.e. OP-17 which was statistically at par Johar-2016 and Faisalabad-08 producing grain yield of 4671 and 4622 kg ha^{-1} respectively. The minimum grain yield of 3827 kg ha^{-1} was received from Chakwal-50.

As far as interaction is concerned coded strain i.e. OP-17 produced higher grain yield of 5185 and 5165 kg ha^{-1} when sown on 15th and 30th of November 2017 respectively. These strains has no significant difference for grain yield statistically. The minimum grain yield of 3827 kg ha^{-1} was received from Chakwal-50 when sown on 15th and 30th of November 2017 respectively.

Table: Effect of different sowing time on yield of Wheat cultivars

VARIETIES	SOWING DATE		
	15-11-17	**30-11-17**	**Mean**
Coded strain (AB-17)	4362 abcde	4774 abcd	4568 b
Coded strain (CD-17)	4280 cde	4362 abcde	4321 bc
Coded strain (EF-17)	4403 abcd	4650 abcd	4527 b
Coded strain (OP-17)	5185 a	5165 ab	5175 a
Roshan-2017	3950 de	4280 cde	4115 bc
Johar-2016	4321 bcde	5021 abc	4671 ab
Faisalabad-2008	4650 abcd	4593 abcd	4622 ab
Chakwal 50	3539 e	4115 de	3827 c
Mean	4337	4620	

LSD 5%: Sowing date =ns, Varieties = 598.7, Interaction = 846.7

Title-115: OPTIMIZING PLANTING TIME FOR LENTIL CULTIVARS IN RAINFED AND IRRIGATED CONDITIONS

The experiment was conducted for the purpose to evaluate optimum planting time for rainfed and irrigated conditions. Three lentil cultivars (Chakwal Masoor, Niab Masoor 2002 and Punjab Masoor 2009) were planted at four different times form 1st week of October to 3rd week of November with fifteen days interval. The experiment was laid out in split plot design keeping plot size of 4m × 1.2m under three repeats.

The results showed significant effects of planting time on cultivars under both conditions. Maximum yield of 444 kg ha^{-1} grain yield was obtained from lentil Chakwal Masoor, when planted during 3rd week of October under rainfed conditions. This yield is statistical at par with Punjab Masoor 2009 (444 kg ha^{-1}). The irrigated conditions significantly contributed towards yields and NIAB Masoor 2002 performed outstanding (1097 kg ha^{-1}), when plated during 1st week of November in irrigated conditions.

Title-116: OPTIMIZING PLANT SPACING FOR DIFFERENT LENTIL CULTIVARS UNDER RAINFED AND IRRIGATED CONDITIONS

Lentil is an important pulse crop for area. It is grown both in rainfed and irrigated conditions. Improper plant density in lentil creates complex competition for water and nutrients. Hence, an experiment was conducted to optimize plant density for different cultivars. Keeping the plant spacing (10 cm, 18 cm & 25 cm) in main plot, three cultivars (Chakwal Masoor, NIAB Masoor 2002 & Punjab Masoor 2009) was randomized in sub plot by employing split plot design. The plot size was kept 4m × 1.2m. The results depicted that response of lentil cultivars were different at different intra row plant spacings under both rainfed and irrigated conditions. Maximum yield (337 kg ha^{-1}) of lentil cultivar (Punjab Masoor 2009) at plant spacing of 25 cm, was obtained in irrigated conditions. The variety was bushy in nature and out yielded well as

compare to other lentil cultivars under irrigated conditions. However, in rainfed conditions, NIAB Masoor 2002 performed good with yield of 358 kg ha^{-1} at plant spacing of 25 cm.

Table: Optimizing different management options for lentil sown under rainfed and irrigated conditions

Treatments	Lentil Grain yield (kg ha^{-1})	
	Rainfed	**Irrigated**
Planting Time (A)		
1st week of October (SD_1)	141 c	255 c
3rd week of October (SD_2)	227 b	559 b
1st week of November (SD_3)	331 a	816 a
3rd week of November (SD_4)	296 a	823 a
Tukey HSD Value at 5%	54.468	100.79
Lentil Cultivars (B)		
Chakwal Masoor (V_1)	270 a	568 b
NM-2002 (V_2)	273 a	666 a
Punjab 2009 (V_3)	204 b	605 b
Tukey HSD Value at 5%	43.597	56.443
Interactions (A×B)		
$SD_1 \times V_1$	129 D	260 F
$SD_1 \times V_2$	111 D	208 F
$SD_1 \times V_3$	184 BCD	295 EF
$SD_2 \times V_1$	83 D	476 DE
$SD_2 \times V_2$	153 CD	674 C
$SD_2 \times V_3$	445 A	528 CD
$SD_3 \times V_1$	444 A	636 CD
$SD_3 \times V_2$	285 B	1097 A
$SD_3 \times V_3$	264 BC	714 BC
$SD_4 \times V_1$	424 A	903 B
$SD_4 \times V_2$	268 BC	684 C
$SD_4 \times V_3$	198 BCD	882 B
Tukey HSD Value at 5%	127.76	165.38

Table: Optimizing different management options for lentil sown under rainfed and irrigated conditions

Treatments	Lentil Grain yield (kg ha^{-1})	
	Rainfed	**Irrigated**
Lentil Cultivars (A)		
Chakwal Masoor (V_1)	274 a	287 a
NM-2002 (V_2)	295 a	260 a
Punjab 2009 (V_3)	186 b	186 b
Tukey HSD Value at 5%		
Plant Spacing (B)		
10 cm (PS_1)	138 b	228 b
18 cm (PS_2)	279 a	212 b
25 cm (PS_3)	337 a	294 a
Tukey HSD Value at 5%	25.03	22.15
Interactions (A×B)		
V_1×PS_1	NS	306 AB
V_1×PS_2	NS	156 DE
V_1×PS_3	NS	222 CD
V_2×PS_1	NS	260 BC
V_2×PS_2	NS	153 E
V_2×PS_3	NS	221 CDE
V_3×PS_1	NS	295 AB
V_3×PS_2	NS	250 BC
V_3×PS_3	NS	337 A
Tukey HSD Value at 5%	-	71.362

Weather Conditions 2017-18

Kharif 2017

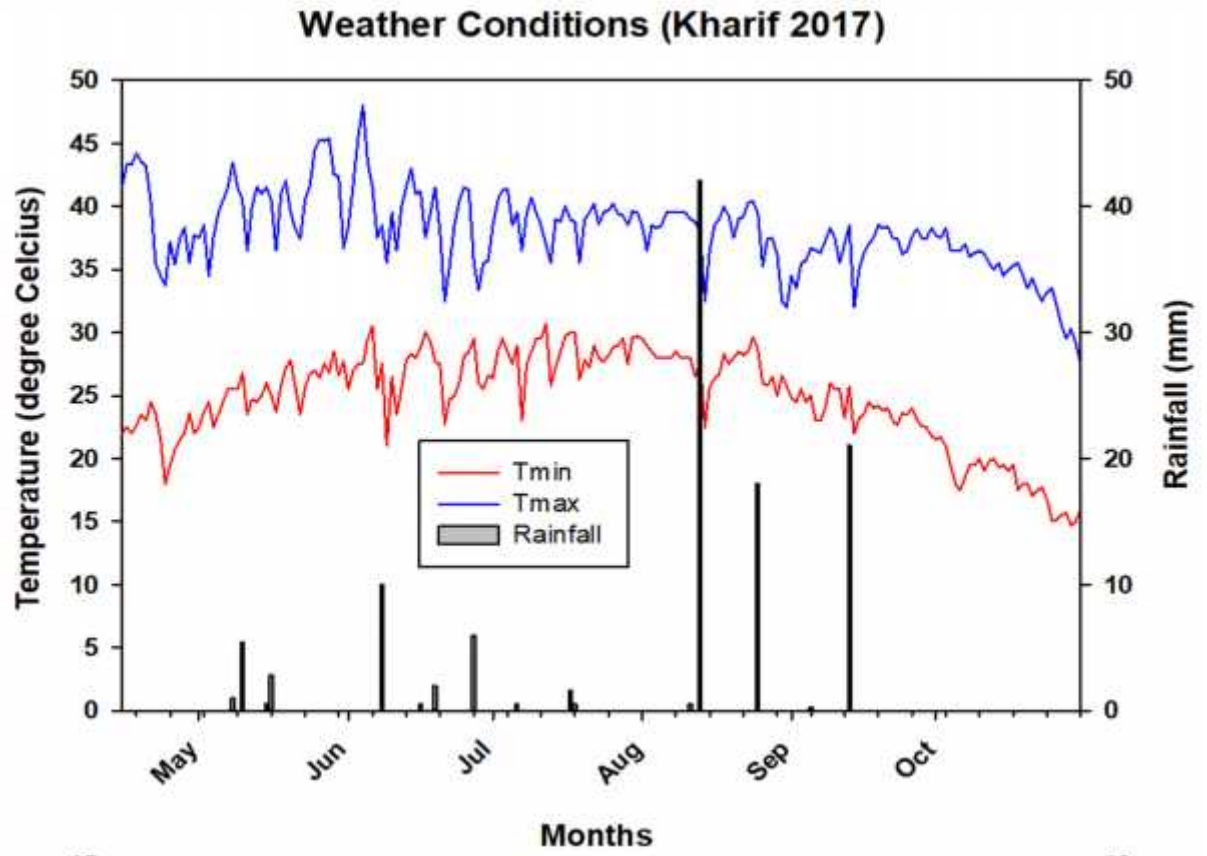
The weather data is presented according to season of the crop. Kharif season is considered from mid-April to October, while Rabi season started from 1st November to Mid-April for the purpose to illustrate weather conditions and their impact on yields. (Fig. 1)

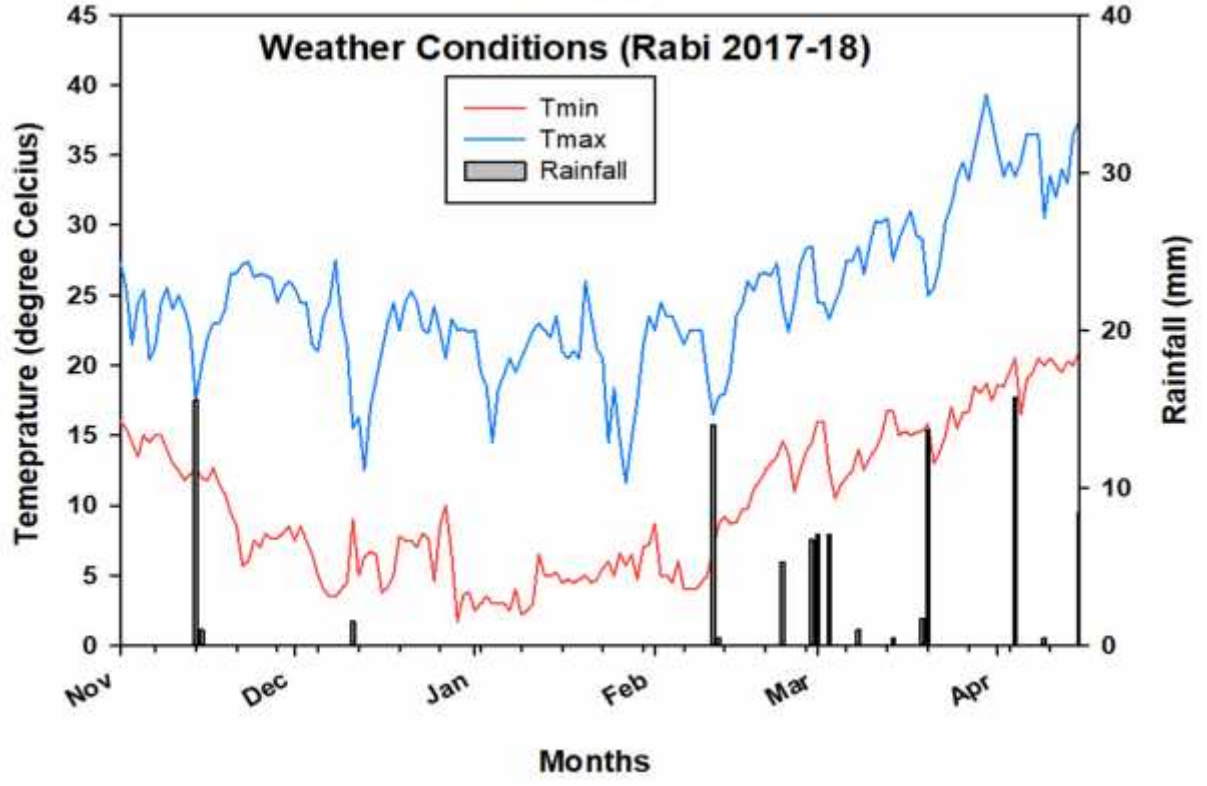
During Kharif 2017, 112.6 mm rainfall was received as compared to 262 mm in 2016, which 42% less in year 2017. Tmax was observed on 28th of May (45.5℃), which is similar to previous year 2016. Tmin was recorded 15℃ in last day of October and started decrease gradually in later.

Rabi 2017-18

Rabi season was very critical in context to weather condition for Wheat crop. The ever-high temperature was recorded during the month of March (39℃) as compare to last year, which is grain filling period of Wheat crop. The fluctuation in temperature severally affected grain filling and cause reduction in wheat yield of district.

The total rainfall in Rabi season was 100 mm, same to previous year 2016. The rainfall occurred in mid-November put positive effects on growth of chickpea in contrary to previous year, where no rainfall was received at the time sowing of wheat and chickpea.


Weather Conditions (Kharif 2017)
Temperature (degree Celcius)
Rainfall (mm)
Tmin
Tmax
Rainfall
May
Jun
Jul
Aug
Sep
Oct
Months


Weather Conditions (Rabi 2017-18)
Temeprature (degree Celcius)
Rainfall (mm)
Tmin
Tmax
Rainfall
Nov
Dec
Jan
Feb
Mar
Apr
Months

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