ANNUAL REPORT

(2019-20)

FODDER RESEARCH INSTITUTE

SARGODHA

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ANNUAL REPORT 2019-20

INTRODUCTION:

Pakistan's economy is mainly agriculture oriented contributing 18.5% of GDP. Livestock is vital sub-sector of Agriculture in Pakistan, accounts 11.22% to overall GDP which is 60.54% of the Agriculture's share to GDP (Economic Survey of Pakistan, 2018-19) and it provides milk, meat and other by-products of animal origin for human nutrition. Pakistan occupies 4th position in milk production in the world and produces 59759 thousand tons of milk per year. The value of milk alone is more than the combined value of two major crops i.e wheat and cotton. Fodder is backbone of the livestock and provides 2 to 3 times cheaper feed than concentrate to livestock. Fodder crops have unique position in context of livestock in our country where more than 70% of our population is directly involved in livestock as a primary source of food and income. Total animal population comprising of cattle, buffalo, goat, sheep and others is 201.9 million in Pakistan (Economic Survey of Pakistan, 2018-19). Fodders occupied an area of 2.45 million hectares producing 55.47 million tones of green fodder out of which Punjab province contribute41.98 million tones production of the country from 1.86 million hectares (Crop Reporting Punjab 2017-18). In Punjab, fodder crops occupying third place after wheat and cotton with average fodder yield of 22.5 t/ha. Major Kharif fodder crops are maize, pearl millet and sorghum.

In order to narrow the gap between the demand and supply, there is a dire need of development for high yielding, highly nutritive, multicut varieties / hybrids of different fodder crops, standardization of their production and protection technology along with seed production of fodder varieties / hybrids. Recently four fodder varieties i.e. Super Green Maize, Punjab Berseem, Super Green Oats and Ever Green Oats have been approved by the Provincial Seed Council for general cultivation. Moreover, spot examination of 2 lines of alfalfa, 2 of sorghum and 1 of guar have been completed and will be presented in upcoming expert sub-committee.

Fodder Research Institute, Sargodha

SORGHUM BREEDING TRIALS

MAINTENANCE OF GEMPLASM OF SORGHUM.

The breeding material comprising 600 varieties/lines (local & exotic) was maintained by selfing. These lines were studied for plant height, number of leaves per plant, leaf area, stem thickness days to 50% heading and sweetness.. Seed of single head of each entry was kept for further study.

HYBRIDIZATION AND FILIAL GENERATION.

With the help of polythene bag technique and manual emasculation about 39 crosses were attempted among the elite lines during the year 2019.

But 15 crosses remained successful. Seed of each F0 cross was threshed separately and preserve to observed the hybrid vigor in the next year F1 generation.

F1 30 crosses sown.

F2 15 crosses were planted. Plants showing better heterogeneity were selected. Seed was preserved for further studies in F3.

F3 to F7 Phenotypic ally uniform lines/progenies were selected for green fodder yield trial, whereas seed of single plant selected from segregating lines was preserved for further studies.

PRELIMINARY FODDER YIELD TRIAL OF SORGHUM

The experiment consisting of 14 lines along with one check variety was sown in order to pin point the highest green fodder yield of sorghum varieties. The trial was laid out in RCBD with 3 replications having a plot size of 1.8x5m in 30cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded and are tabulated below:-

Table-1 GREEN FODDER YIELD

Sr. No.	Lines/varieties	Green Fodder Yield (t/ha)
1	Jable	74.81
2	Yss-15	74.81
3	I-6	72.59
4	Yss-89	72.22
5	No-6197	72.22
6	SD-167	69.26
7	F-03-2018	67.04
8	FRI-02	66.30
9	No-39501	66.30
10	Sorghum-2011	65.93
11	F-02-2018	63.70
12	65174-2	62.59
13	JS-2002	61.48
14	F-01-2018	55.56
	LSD 5%	5.11

On the perusal of Table-1, it was noted that line jable produced maximum green fodder yield (74.81 t/ha.) followed by the line YSS-15 (74.81 t/ha.).

ADVANCED GREEN FODDER YIELD TRIAL OF SORGHUM

8 lines/ varieties were tested for their green fodder yield potential. The trial was laid out in RCBD with 3 replications having a plot size of 1.8x5m in 30cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded below (Table-2).

Table-2 GREEN FODDER YIELD (t/ha.)

Sr. No.	Lines/varieties	Green Fodder Yield (t/ha)
1	SGD-02-2017	74.07
2	F-01—2017	71.85
3	SGD-01-2017	68.52
4	Sorghum-2011(Check)	67.04
5	JS-2002(Check)	66.67
6	No-5017	65.93
7	F-02-2017	60.74
8	No-1863	51.48
	LSD 5%	4.32

Line SGD-02-2017 out yielded by giving maximum green fodder yield (74.07t/ha.) followed by line F-01—2017 (71.85 t/ha.).

ZONAL GREEN FODDER YIELD TRIAL OF SORGHUM

Eight lines/ varieties were tested for their green fodder yield potential. The trial was laid out in RCBD with 3 replications having a plot size of 1.8x5m in 30cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded and are given below:-

Table-3 GREEN FODDER YIELD (t/ha.)

Sr. No.	Variety/ line	FRI. Sgd.	FRSS, F/Abad	ESPU Farooqabad	ARS. B/pur	Average.
1.	S-145	72.96	72.2	46.66	37.4	57.31
2.	FRI-07	61.85	64.07	57.77	35	54.67
3.	PVK-801	71.48	64.81	46.28	36	54.64
4.	Sorghum-2011 (check)	61.67	62.59	48.51	43.3	54.02
5.	F-02-2016	65.56	72.59	42.22	35	53.84
6.	JS-2002 (check)	60.7	61.85	48.14	43.1	53.45
7.	F-01-2016	65.56	54.07	38.5	47.6	51.43
8.	JS-1	62.59	61.11	41.47	39.9	51.27
	LSD 5%	4.11	7.02			

PEARL MILLET BREEDING TRIALS

COLLECTION AND MAINTENANCE OF GERMPLASM.

100 genotypes were planted in paired rows isolated by sorghum. Material was well managed through timely field operations. The selected heads of variety/ line were bagged and tagged. The seed of these heads was collected and stored for further studies.

HYBRIDIZATION & SELECTION OF PEARL MILLET

12 crosses were attempted to create the genetic variability through hand emasculation. Detail of crosses is given below.

Table-4

Purpose	Number of crosses
Multicut	4
Green Fodder Yield	4
Dual Purpose (Grain/Fodder)	4
Total	12

PRELIMINARY GREEN FODDER YIELD TRIAL.

The experiment consisting of 12 lines was sown in order to pin point the highest green fodder yielding line of millet. The trial was laid out in RCBD with 3 replications having a plot size of 1.5x6m in 30cm apart rows. The crop was harvested at 50 % heading. Green fodder yield data were recorded and are given below:-

Table-5 GREEN FODDER YIELD

S.No.	Varieties / Lines	Green Fodder Yield (t/ha.)
1	N.5	75.13
2	PM.03.2017	73.91
3	DP. POP	72.37
4	PM.04.2017	72.07
5	PM.05.2017	71.76
6	High Group	71.76
7	PM-01-2017	70.84
8	DBR III	70.84
9	PM.06.2017	70.53
10	POP.01	70.23
11	Composite IV	69.00
12	PM02-2017	68.69
	LSD	4.19

Data showed that line N-5 gave maximum green fodder yield (75.13 t/ha.) and was followed by line PM.03.2017 (73.91 t/ha.).

ADVANCED GREEN FODDER YIELD TRIAL

The trial consisting of 8 promising line/ varieties was laid out in RCBD with 3 replications having a plot size of 1.8x6m in 30cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded and is given below:-

Table-6 GREEN FODDER YIELD

S.No.	VARIETIES / LINES	GREEN FODDER YIELD (t/ha)
1	Tift 85D	76.36
2	H.72	76.05
3	TifT383	75.44
4	Sen POP	74.83
5	Composite III	74.52
6	DP.PAK	74.21
7	PM.01.2016	72.99
8	Sgd. Bajra 2011(check)	69.92
	LSD	4.63

Data showed that line / variety Tift 85D produced maximum green fodder yield (76.36 t/ha.) and was followed by H-72 (76.05t/ha.).

ZONAL GREEN FODDER YIELD TRIAL OF PEARL MILLET

Trial consisting of 4 lines was conducted at four different location of Punjab to test the stability and green fodder yield of millet. Average data of all locations is given below

Table-7 GREEN FODDER YIELD

Sr. No	LINES/VARIETIES	Green Fodder Yield (t/ha)				
		FRI, Sgd.	FRSS, F/Abad	ARS, B/pur.	ESPU, Fq.Abad	Average
1	G.White	72.68	64.10	84.70	93.50	78.74
2	FB.809	73.29	57.00	70.70	96.29	74.32
3	Q Bajra	76.97	61.30	76.00	82.40	74.16
4	FB.791	70.84	59.20	81.30	85.00	74.08
5	Sgd.Bajra 2011 (Check)	71.15	62.60	81.00	76.00	72.68
	LSD	5.47	N.S	4.36	8.12	

MAIZE

MAINTENANCE AND SEED PRODUCTION OF MAIZE GERMPLASM

Breeding material consisting of 58 lines was sown in 60cm apart rows of 14-meter length. The genotypes were properly maintained through timely bagging and rouging off type plants. Seed of these genotypes was collected for further studies.

DEVELOPMENT OF COMPOSITE VARIETY OF MAIZE

Equal quantity of 5 different lines were mixed and allowed random mating through open pollination. Seed of $C_1$and C2 and C3 generations were collected for further study and selection process.

PRELIMINARY FODDER YIELD TRIAL OF MAIZE

The trial consisting of 9 promising line/ varieties was laid out in RCBD with 3 replications having a plot size of 1.8x5m in 30cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded and is given below:-

Table-8 GREEN FODDER YIELD

Sr. No.	Varieties/ Lines	Green Fodder Yield (t/ha)
1	MS-05-2018	58.51
2	MS-06-2018	55.92
3	Composite-01-18	52.22
4	Composite-02-18	51.11
5	MS-04-2018	50.74
6	MS-02-2018	48.51
7	Sgd.2002 (Check)	46.66
8	MS-07-2018	42.59
9	MS-03-2018	38.89
10	MS-01-2018	37.77
	LSD (5%)	4.36

Data showed that line ‘MS-05-2018’ gave higher green fodder yield 58.51 t/ha and followed by line MS-06-2018 (55.92 t/ha.).

ADVANCED FODDER YIELD TRIAL OF MAIZE

6 lines/ varieties were tested for their green fodder yield potential. The trial was laid out in RCBD with 3 replications having a plot size of 1.8x5m in 30cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded below

Table-9 GREEN FODDER YIELD

Sr. No.	Varieties/ Lines	Green Fodder Yield (t/ha)
1	Composite-15	54.07
2	MS-05-2017	53.70
3	MS-01-2017	53.33
4	MS-03-2017	51.48
5	Sgd.2002 (check)	49.25
6	MS-04-2017	44.81
7	Composite-16	38.15
LSD (5%)		2.64

ADAPTABILITY GREEN FODDER YIELD TRIAL OF MAIZE

Seven advance lines /varieties were tested at different locations of Punjab province for their green fodder yield and adaptability.

The average data of green fodder yield is given below.

Table-10 GREEN FODDER YIELD

Sr. No.	Lines / Varieties	FRI, Sargodha	FRSS, F/Abad	ARS, B/Pur	ESPU, Farooqabad	Average (t/ha.)
1	MS-01-2016	48.51	59.65	68.88	28.88	51.48
2	MS-04-2016	57.03	61.99	55.92	28.51	50.86
3	MS-07-2016	48.51	60.43	62.99	30.73	50.67
4	FSD.2020	51.11	57.31	46.29	30.50	46.30
5	MS-03-2015	46.29	58.09	42.96	33.70	45.26
6	MS-05-2016	38.51	60.62	49.62	27.77	44.13
7	Sgd.2002 (Check)	47.40	57.70	43.7	27.40	44.05
8	FSD.2025	36.29	54.19	52.21	27.30	42.50
	LSD 5%	4.58				

S.S. HYBRID TRIALS

MAINTENANCE AND SEED PRODUCTION OF RED LANE 'A' & 'B' LINES

Red lane 'A' & 'B' lines were planted for maintenance. One row of 'B' line (male) was sown on either side of two rows of `A' line (female). Male fertile plants were rouged out from `A' line to ensure its purity. Seed was preserved for further studies.

COWPEAS BREEDING TRIALS

MAINTENANCE OF GERMPLASM

32 genotypes were sown in 120 cm apart rows for their maintenance. The trial was well managed through timely cultural operations. Off-type plants were rogued out for purity maintenance. Different morphological characters were recorded. The seed was preserved for further use in breeding programme.

PRELIMINARY FODDER YIELD TRIAL OF COWPEAS

The trial was planned to evaluate yield potential of different cowpeas lines/ varieties for testing their green fodder yield potential. The experiment was laid out in RCBD with 4 replications having a plot size of 3x6m. The green fodder yield data are given in the table.

Table-11 GREEN FODDER YIELD

S. No	Lines/varieties	Green fodder yield (t/ha)
1	CP-95	43.06
2	CP-035	42.30
3	CP-96	41.93
4	CP-101	41.83
5	CP-219	40.40
6	Elite	36.92
7	Rawan-2003 (check)	36.75
8	SS-92	36.68
9	SS-92-2	35.56
10	IT-82E-715	34.93
11	AYT-CP-012	34.79
12	AYT-CP-021	34.43
	LSD	2.70

Data showed that line/ variety CP-95 gave maximum green fodder yield (43.06 t/ha.) and was followed by line CP-035 which yielded 42.30 t/ha.

ADVANCE GREEN FODDER YIELD TRIAL OF COWPEAS

Six lines/ varieties were tested for their green fodder yield potential. The trial was laid out in RCBD with 3 replications having a plot size of 3mx6m in 30cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded below.

Table-12 GREEN FODDER YIELD

S.No	LINES/VARIETIES	Green Fodder Yield (t/ha)
1.	CP-271	40.40
2.	IT-82E-715	39.30
3.	CP-96	39.25
4.	CP-219	35.50
5.	CP-162	35.11
6.	Rawan-2003 (check)	33.50
7.	Elite	33.30
	LSD 5%	2.30

Data revealed that line cp-271 stood high yielder with a yield of 40.40 t/ha.

ADAPTABILITY GREEN FODDER YIELD TRIAL OF COWPEAS

Seven advance lines /varieties were tested at different locations of Punjab province for their green fodder yield and adaptability.

The average data of green fodder yield is given below.

Table-13 GREEN FODDER YIELD

Sr. No.	Lines/ Varieties	FRI, Sargodha	Agronomy (F.P) AARI	BARI, Chakwal	ESPU, Farooqabad	Average (t/ha.)
1	CP-383	33.86	36.04	18.80	39.93	32.15
2	CP-145	33.12	29.30	16.41	38.13	29.24
3	CP-271	32.88	25.00	18.12	38.69	28.67
4	IT84-D-552	31.62	23.29	17.91	39.62	28.11
5	Rawan-2003 (check)	27.23	31.83	17.70	35.60	28.09
6	CP-162	30.90	23.29	17.29	37.92	27.50
7	CP-219	24.65	27.98	17.96	34.00	26.15
	LSD 5%	0.50	-	-	-	

BNS & PRE-BASIC SEED PRODUCTION

Pre basic and basic seed of all the kharif fodders was produced. The crop wise detail is given below.

Table-14 BNS & Pre-basic Seed Production

Crops	Varieties	Selected No. of Heads.	Selected No. of Head -Row.	Selected row to block.	BNS (kg.)	Pre-Basic (kg.)
Sorghum	Hegari	50	36/50	21/32	48	2574
	JS-263	30	24/50	15/30	27	537
	JS-2002	50	32/50	16/28	35	1317
	Sorghum2011	50	33/50	13/24	31	1375
Pearl Millet	MB-87	30	21/30	12/20	15	79
	Sgd. Bajra	30	18/30	7/12	9	702
Maize	Sgd. 2002	50	40/50	19/28	205	4709

OATS BREEDING TRIALS

COLLECTION, EVALUATION AND MAINTENANCE OF GERMPLASM OF OATS

130 entries/lines were planted in 30 cm apart in paired rows. Off-type plants were rogued out to maintain their purity. Out of these, 20 were ranked early, 71 medium and 17 late. The seed of these lines was preserved for further studies.

HYBRIDIZATION PROGRAMME OF OATS

Hybridization work was carried out to create genetic variability. 35 crosses were attempted. Out of 35, 12 crosses were successful. These were harvested and the seed was reserved for further studies.

STUDY OF FILIAL GENERATIONS OF OATS

Different generations of oats, F_2 to F_6 were studied and desirable recombinants were selected for next filial generation.

Table-15 Filial Generations

Fillial Generations	**crosses /progenies studied**	**Crosses/progenies selected**	**Uniform Lines Selected**
F1	12	12	-
F2	5	60 plants of 5 crosses	-
F3	60 plants of 5 crosses	40 plants of 4 crosses	-
F4	32 plant progenies of 4 crosses	24 plants of 3 crosses	-
F5	18 plant progenies of 3 crosses	12 plants of 2 crosses	-
F6	10 plants progenies of 2 crosses	2	2

PRELIMINARY GREEN FODDER YIELD

A trial comprising of 12 lines/ varieties was laid out in RCBD with 3 replications having a plot size of 2.4 x 6.0m in 30 cm apart rows. Different morphological characters were recorded. Crop was harvested at 50% heading. Green fodder yield data were recorded and is given below:-

Table-16 GREEN FODDER YIELD

S.No.	**Line / Variety**	**G.F.Y. (t/ha)**
1	No. 2088	82.11
2	No. 663	81.18
3	FRI -2008	81.18
4	No. 97018	78.19
5	No. 615	78.19
6	F146	73.83
11	Sgd Oats 2011 (Check)	72.96
12	S -2000 (Check)	70.34
7	FRI-683	69.00
8	FO- 1-18	69.00
10	FO-2-18	66.00
11	FRI -152	59.10
LSD5% (11.5)		

Data revealed that line / variety NO.2088 gave maximum green fodder yield (82.11 t/ha.) and was followed by lines NO. 663 (81.18t/ha.).

ADVANCED GREEN FODDER YIELD TRIAL.

The trial consisting of 10 promising lines/ varieties was laid out in RCBD with 3 replications having a plot size of 2.4 x6m in 30cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded and is given below:-

Table-17 GREEN FODDER YIELD

S.No.	Name of Lines/ Varieties	Green Fodder Yield(t/ha)
1.	No.669	92.01
2.	No -668	83.94
3.	FRI-034	81.64
4.	FRI-153	80.26
5.	F-401	80.00
6.	No- 85-125	78.58
7.	FRI -6001/15	78.19
8.	Oats 2011 (Check)	76.52
9.	FRI-152	75.21
10.	S- 2000 (Check)	74.73

Data revealed that the line NO.669 out yielded all the entries included in the trial by giving 92.01 t/ha green fodder yield and was followed by N-668 (83.94 t/ha.).

ADAPTABILITY GREEN FODDER YIELD TRIAL OF OATS

In order to pin point the best oats lines/ varieties, adaptation yield trial with 14 varieties was laid out in RCBD with 3 replications having a plot size of 1.8x6m. Data of green fodder yield were noted at 50% heading and are presented below:-

Table-18 GREEN FODDER YIELD

Lines/ Varieties	Green Fodder Yield (t/ha)			
	FRI Sargodha	FRRS Faislabad	ESPU Farooqabad	ARS Bahawalpur
SGD-1	105.08	95.68	96.31	97.57
FRI-03	101.02	89.84	97.24	101.03
No-632	91.33	95.36	95.13	107.01
FRI-01	94.21	90.76	89.81	102.29
FRI-02	88.81	84.02	91.66	110.78
F-415	89.08	96.28	94.20	95.05
SGD Oat 2011 (Check)	82.85	94.14	93.28	103.55
ERK	84.50	93.52	93.75	99.46
S-2000 (Check)	80.70	94.44	94.44	96.94
CK-1	90.16	81.56	92.81	100.71
SGD-46	80.08	82.80	85.87	100.71
No-677	88.93	95.68	71.22	92.62

BERSEEM BREEDING TRIALS

MAINTENANCE OF GERMPLASM.

Sixty genotypes of berseem were planted in isolation. The material was well managed through timely field operations. Off-type plants were rouged out for purity maintenance. The seed was collected and stored for further studies.

PRELIMINARY GREEN FODDER YIELD TRIAL

Field trial consisting of 10 lines/ varieties of Berseem was planted to evaluate them for green fodder yield potential. The experiment was laid out in RCBD with 3 replications having a plot size of 3x5m. the trial was conducted at two locations .The yield data was recorded and is given below:-

Table-19 GREEN FODDER YIELD

S. No.	Lines/ Varieties	Green Fodder Yield (t/ha)		
		FRI, Sargodha	FRSS, F/Abad	Avg.
1.	FB-1-18	115.7	138.7	127.2
2.	FB-2-18	117.6	135.8	126.7
3.	SB-1-18	120.3	125.8	123.0
4.	SB-4-18	117.9	121.6	119.7
5.	SB-6-18	110.8	120.9	115.9
6.	Anmol (check)	109.4	121.1	115.3
7.	SB-5-18	111.9	118.2	115.1
8.	Agaiti (check)	106.7	116.7	111.7
9.	SB-2-18	106.3	113.8	110.0
10.	SB-3-18	107.3	110.9	109.1
	LSD (5%)	8.4	11.5	

Data revealed that line / variety FB-1-18 gave the maximum green fodder yield (127.2 t/ha.) and was followed by the Line / variety FB-2-18 (126.7t/ha.) and check variety Agaiti (111.7t/ha.)

ADVANCED GREEN FODDER YIELD TRIAL

Field trial consisting of 08 lines of Berseem was planted to evaluate them for green fodder yield potential. The experimental was laid out in RCBD with 3 replications having a plot size of 3x5m. The trial was conducted at two locations. The yield data was recorded and is given below:-

Table-20 GREEN FODDER YIELD

Sr.No	Lines/ varieties	Green Fodder Yield (t/ha)		
		FRI, Sargodha	FRSS, F/Abad	Avg.
1.	FB-2-17	133.3	127.6	130.45
2.	SB-4-17	138.4	122	130.22
3.	SB-1-17	135.3	119.3	127.33
4.	SB-3-17	128.9	122.4	125.66
5.	FB-1-17	130	120.2	125.10
6.	Agaiti (check)	135.6	109.8	122.67
7.	SB-2-17	125.6	115.5	120.53
8.	Anmol (check)	129.1	109.8	119.45
	LSD 5%	11.1	5.12	

Data revealed that line / variety FB-2-17 gave the maximum green fodder yield (130.45 t/ha.) and was followed by the line / variety SB-4-17 (130.22t/ha.).

ADAPTABILITY GREEN FODDER YIELD TRIAL

Field experiment consisting of 6 lines/ varieties of berseem was planted to evaluate for green fodder yield potential. The experiment was laid out in RCBD with 3 replications having a plot size of 3x5m.the trial was conducted at different ecological conditions of Punjab. The yield data was recorded and is given below:-

Table-21 GREEN FODDER YIELD

Sr. No	Lines / Varieties	Green Fodder Yield				
		FRI, Sargodha	FRSS, F/Abad	ARS, B/Pur	ESPU, Farooqabad	Avg.
1.	FB-2-16	137.8	118.7	90	114.7	115.3
2.	SB-3-16	143.1	106.4	83.04	123.1	113.9
3.	SB-5-16	131.6	114.7	88.68	113.1	112.1
4.	FB-1-16	142.2	96.9	82.68	117.8	109.9
5.	SB-2-16	139.1	88.2	78.96	118.4	106.2
6.	Agaiti (check)	133.8	102.4	78	110.4	106.2
7.	Anmol(check)	132.7	84.2	83.53	113.6	103.5
	LSD 5%	14.4	2.3	5.6	15.7	

Data showed that line FB-2-16 gave maximum green fodder yield (115.3t/ha.) followed by line / variety SB-3-16 (113.9t/ha.).

NATIONAL UNIFORM FODDER YIELD TRIAL OF BERSEEM

A trial consisting of 7 coded lines received from National Coordinator (Fodder), NARC, Islamabad was laid out with the objective to find out a variety/ line with higher green fodder yield potential. Methodology was adopted according to the plan proposed by the National Coordinator (Fodder), NARC, Islamabad. Green fodder yield data is presented in table below:-

Table 22: Green Fodder Yields of National Uniform Fodder Yield Trials (NUFYTs)

HYBRID/ VARIETY	Green Fodder Yield (t/ha)						
	FRI, Sargodha	NARC Islamabad	ARS Faisalabad	AZRI Bhawalpur	Tarnab	Okara	Mean
Agaiti (check)	114.67	127.36	93.89	193.17	47.98	59.98	106.17
Samarqand berseem	122.44	135.83	95.56	165.67	47.47	59.34	104.38
Sb-3-15	111.78	124.44	93.33	181.95	46.12	57.65	102.55
Anmol (check)	107.33	138.75	98.33	208.33	46.45	58.06	109.54
SB-7-14	110.67	122.78	90.00	221.22	36.42	45.53	104.44
Sandal Berseem	120.89	138.47	99.17	180.90	47.85	59.81	107.85
CV%	4.96	7.18	5.09	-	46.35	6.76	-
LSD	10.33	17.15	7.04	-	22.95	16.09	-

LUCERNE BREEDING TRIALS

COLLECTION AND MAINTENANCE OF GERMPLASM.

200 Lucerne genotypes were sown in 60 cm apart rows of 10-meter length The genotypes were properly maintained. Seed of these genotypes was collected for further studies.

PRELIMINARY GREEN FODDER YIELD TRIAL

Field trial consisting of 10 lines/ varieties was planted to evaluate them for green fodder yield potential. The experimental was laid out in RCBD with 3 replications having a plot size of 1.8x5 m in 30cm apart rows. The yield data was recorded and is given below:-

Table-23 GREEN FODDER YIELD

S.No	Lines / Varieties	Green Fodder Yield (t/ha)
1.	Viger-02	138.16
2.	Viger-01	136.49
3.	No.1103	136.05
4.	Bover	134.86
5.	China	134.05
6.	KQS-02	132.75
7.	No.1107	132.64
8.	GR-800	132.23
9.	Viger-05	129.50
10.	Sgd. Lucerne 2002 (check)	128.83
11.	565-82	121.54
LSD 5%		3.505

Data showed that line Viger-02gave maximum green fodder yield (138.16t/ha.) followed by Viger-01 (136.49t/ha.).

ADVANCED GREEN FODDER YIELD TRIAL OF LUCERNE

Field trial consisting of 12 lines/ varieties was planted to evaluate them for green fodder yield potential. The experimental was laid out in RCBD with 3 replications having a plot size of 1.8x5 m in 45cm apart rows. The yield data was recorded and is given below:-

Table-24 GREEN FODDER YIELD

Sr.No	Lines / Varieties	Green Fodder Yield (t/ha)
1.	ICON-13	139.74
2.	SARD-10	139.08
3.	5-IN-59	138.97
4.	Silverado	136.49
5.	No. 53	134.53
6.	SGS-82	134.42
7.	No.7613	134.35
8.	CUF-101	134.05
9.	FRI001	134.05
10.	Sunder	134.01
11.	Sgd. Lucerne (check)	132.19
12.	Oman	127.83
LSD 5%		4.337

Data showed that line ICON-13gave maximum green fodder yield (139.74t/ha.) followed by SARD-10 (139.08t/ha.).

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ADAPTABILITY GREEN FODDER YIELD TRIAL

Field trial consisting of 7 lines/ varieties was planted to evaluate them for green fodder yield potential. The experimental was laid out in RCBD with 3 replications having a plot size of 1.8x5 m in 45 cm apart rows. The yield data was recorded and is given below:-

Table-25 GREEN FODDER YIELD

Sr #	Line /Verity	Green Fodder Yield (t/ha)				
		FRI Sgd	FRSS F/Abad	ARS B/Pur	ESPU Farooqabad	Average (t/ha)
1	C-312	110.00	101.17	83.00	88.33	107.61
3	GR-745	115.33	101.67	79.33	80.00	105.62
5	GR-722	117.67	100.00	83.33	68.33	103.42
2	Sgd. Lucerne 2002 (Check)	86.33	101.67	80.00	84.33	96.89
4	Fsd. Lucerne	89.67	107.67	80.67	72.00	96.25
6	Hunter River	89.33	93.33	86.00	66.67	92.22
7	No.1103	65.00	121.17	69.33	50.33	86.85

Data showed that line C-312 gave maximum green fodder yield (107.61t/ha.) followed by GR-745 (105.62t/ha.).

BNS & PRE-BASIC SEED PRODUCTION

Production of BNS and pre-basic seed of berseem, Lucerne and Oats was done according to the recommended protocols. The details of rabi crops BNS and pre basic seed is given below.

Table-26 BNS & Pre-basic Seed Production

Crop	Variety	Selected No. of Plants	Selected No. of Plant Rows	Selected No. of Row Blocks	BNS (Kgs)	Pre-basic (Kgs)
Berseem	Agaiti	50	64/100	36/46	126	1425
	Pachaiti	50	60/100	32/40	98	1273
	Anmol	50	72/100	18/22	78	2648
Oats	S-2000	50	68/100	25/40	164	3036
	Sgd-2011	50	56/100	28/36	226	2942
Lucerne	Sgd-2002	50	32/50	27/36	17	213

AGRONOMY TRIALS

EFFECT OF DIFFERENT SEED RATE ON GREEN FODDER YIELD OF ADVANCE LINE OF SORGHUM NO. 1572

This trial was conducted to find out the optimum seed rate of a new promising line of sorghum no.1572 for obtaining maximum G.F.Y. five different seed rates 60, 70,80,90 and 100 kg/ha were used. The system of lay out was RCBD with 34 replications having plot size of 2.7x6m.It was sown in the month of July . Data regarding G.F.Y was recorded and given below.

Treatments (Seed rate)	Green Fodder Yield (t/ha)
T1 (60 kg/ha)	106.00a
T2 (70 kg/ha)	96.50ab
T3 (80 kg/ha)	90.50b
T4 (90 kg/ha)	89.5b
T5 (100 kg/ha)	88.75b
LSD 5%	9.71

A new promising line of sorghum (no.1572) differed significantly in G.F.Y at different seed rates. It yielded higher green fodder (106 t/ha) at a seed rate of 60 kg/ha followed by 96 t/ha G.F.Y At a seed rate of 70kg/ha.

EFFICACY OF DIFFERENT WEEDICIDES ON S.S HYBRID.

The study was conducted to find our most effective weedicide to control weeds in ss hybrid. Experiment was conducted in RCBD design with 4 replications. The effect of different weedicides is given below in table.

Weedicides	**Treatments**	**Yield t/ha**
Clodinafop(propergyl	T1 = 01 g/ litre water just after 1st cut.	76.00b
	T2 = 1.5 g / litre water just after 1ST cut.	76.25b
Paraquat	T3 = 6 ml/ litre water just after 1st cut	78.50b
	T4 = 8 ml/ litre water just after 1st cut	77.50b
Round up	T5 = 6ml/ litre water just after 1st cut	92.75a
	T6 = 8ml/ litre water just after 1st cut	96.00a
Poma super	T7 = 4ml/ liter water just after 1st cut	75.75b
	T8 = 6 ml/ liter water just after 1st cut.	76.25b
Control	T9 = control	49.00c
LSD 5%		6.23

EFFECT OF DIFFERENT ROW SPACING ON G.F.Y.OF PROMISING LINE OF MAIZE (SM.2010)

This trial was conducted to find out the optimum row spacing of new promising line of maize (SM2010)for obtaining maximum G.F.Y. Three different row spacing (15, 30, 45cm) were used .The experiment was laid out in RCBD with 3 replications having plot size of 1.8x5m. It was sown in the month of March .Data regarding G.F.Y was recorded &is given below.

Sr, No	**Row spacing cm**	**Green fodder yield t/ha**
1	15	51.33
2	30	54.16
3	45	53.16

Cd1 = 4.50

A new promising line of maize (SM-2010) differed significantly in green fodder yield at different row spacing. It yielded higher green fodder (54.16t/ha at a row spacing of 30cm followed by a row spacing 45cm with a G .F.Y of 53.16.t/ha.

GREEN FODDER YIELD PERFORMANCE OF DIFFERENT VARIETIES /LINE OF MAIZE.

The experiments was laid out to find out a line having highest green fodder yield. Seven lines / varieties were tested. RCBD was used with 3 replications and 1.8 x 5m plot size. The experiment was sown in March. Green fodder yield data was recorded and is given below:-

Sr.No	Varieties/ Lines	Green fodder yield t/ha
1	SM.2010	57.00
2	Sgd. Maize 2002	53.50
3	SW -2002	31.50
4	Pearl maize	42.00
5	Local maize	37.00
6	F2 maize	40.50
7	Desi maize	38.00

Cd1 =6.70

A new promising line of maize (SM.2010) differed significantly in Green fodder yield as compare to other varieties / lines of maize. It gave higher green fodder yield (57.00t/ha followed by maize seed 2002 with 53.50 t/ha

EFFECT OF DIFFERENT SEED RATES AND ROW SPACING ON G.F.Y. OF PROMISING LINE OF SORGHUM (PAK –CHINA -1)

This agronomic trial was conducted to find out the optimum seed rate & row spacing of a new promising line of sorghum (Pak china -1).Four different seed rate 70,80,90,and 100kg/ha were used . Three sowing methods having row spacing of 15,30,45cms were used. The system of lay out was split plot design with 3 replications .having plot size of 1.8x5m .It was sown in the month of July .Data regarding G.F.Y.was recorded and is given below.

Sr.No	Seed rates kg/ha	Green fodder yield t/ha Row spacing (cm)		
		15	30	45
1	70	61.11	63.23	56.01
2	80	63.41	73.75	57.61
3	90	63.13	62.01	55.81
4	100	58.62	59.11	54.82

Cd1=7.16

Data regarding G.F.Y indicated that 30cm row to row distance with 80kg/ha seed rate produced maximum green fodder yield 73.75 t/ha.

EFFECT OF DIFFERENT SEED RATES &ROW SPACING ON G.F.Y OF PROMISING LINE OF MILLET (FD-795)

This agronomic trial was conducted to find out the optimum seed rate row spicing of a new promising line of millet –(F-B795)for maximum G.F.Y. Four different seed rates (12.5,15,17,5 and 20kg/ha) were used .Three sowing methods having row spacing of 15.30.and 45cm were used .The system of lay out was split –plot size of 1.8x5m.It was sown in the month of July .Data regarding G.F.Y was recording & is given below.

Sr.No	Seed rates kg/ha	Green fodder yield t/ha Row spacing (cm)		
		15	30	45
1	12.5	59.11	61.22	54.21
2	15	60.41	71.76	55.56
3	17.5	61.16	60.11	53.72
4	20	56.61	57.21	52.61

Cd1=7.80

Data regarding G.F.Y indicated that a new promising line of millet (FB.795) gave maximum G.F.Y (71.76t/ha) at a seed rate of 15 kg/ha with row spacing of 30cm.

EFFECT OF DIFFERENT SEED RATES ON G.F.Y OF PROMISING LINES OF BERSEEM.

This agronomic trial was conducted to find out the optimum seed rates of new promising lines of Berseem for obtaining maximum G.F.Y. four different seed rates (10,15,20, and 25kg/ha) were selected . The system of lay out was split plot design with three replication having Plot size of 3x5m. It was sown in the 2nd week of October. Data regarding G.F.Y was recorded and is giving below.

Sr.No	Varieties lines	GREEN FODDER YIELD t/ha Seed rates kg/ha			
		10	**15**	**20**	**25**
1	Sandal	81.98	96.65	101.32	92.66
2	Chenab	94.00	91.99	103.32	96.39
3	B. Pachaiti check	65.90	74.34	83.32	65.93

Cd1= 5.75

A new promising line of Berseem (Chenab) differed significantly in G.F.Y at different seed rates. It yielded higher G.F.Y (103.32t/ha) at a seed rate of 20kg/ha as compare to check variety. B. Pachaiti which gave 83.32 that G.F.Y. while Sandal remains 2nd which gave 101.32t/ha G.F.Y at a seed rate of 20 kg/ha.

EFFECT OF DIFFERENT METHODS OF NITROGEN APPLICATION ON G.F.Y.OF PROMISING LINE OF OAT(F-411)

This agronomic trial was conducted to find out the best method of nitrogen application for obtaining maximum G.F.Y of a new variety/line of Oat was R C B D with 3 replication having plot size 1.8x5m. Data regarding G.F.Y was recorded given below.

Sr.No	Treatments	G.F.Y (t/ha)
1	Control	55.55
2	Broad Cast	41.53
3	Drilling along the rows	85.11
4	Side Placement	80.36

Cd1=6.11

A new promising line of Oat (F-411) gave maximum (G.F.Y 85.11 t/ha) when nitrogen applied by drilling along the rows followed by side placement which gave 80.36 t/ha G.F.Y.

EFFECT OF DIFFERENT SEED RATES & ROW SPACING ON G.F.Y OF PROMISING LINE OF OAT (F-411)

This agronomic trial was conducted to find out the optimum seed rate & row spacing of a new line of Oat F-411 for obtaining maximum G.F.Y. Four different seed rates (70, 80,90 and 100kg/ha) were used. Tree sowing methods having row spacing of 15,30and 45cm.The

system of lay out was split plot with three replication having plot size of 1.8x5m. It was sown in second week of October. Data regarding G.F.Y was recording & is given below.

Sr.No	Seed rates kg/ha	Green fodder yield t/ha Row spacing (cm)		
		15	**30**	**45**
1	70	41.47	83.65	81.11
2	80	93.33	97.77	92.22
3	90	90.00	94.44	90.00
4	100	88.88	93.33	88.95

Cd1=4.44

Data regarding G.F.Y indicated that a new promising line of Oat (F-411) gave maximum G.F..Y (97.77t/ha) at a seed rate of 80kg /ha with row spacing of 30cm.

SCREENING OF PROMISING LINES/VARIETIES OF OATS FOR G.F.Y UNDER WATER STRESS CONDITION

This agronomic trial was conducted to find out a line/variety of Oat which can give maximum G.F.Y under water stress condition. Ten different lines/varieties were under. The system of lay out was R C B D with 3 replication having plot size of 1.8x5m.It was sown in the month of November. Data regarding G.F.Y was recorded and is given below.

Sr.No	Line/variety	Green Fodder Yield (t/ha)
1	S-2000	24.40
2	Ravi	27.00
3	F-417	50.66
4	F-414	34.00
5	F-402	45.55
6	F-411	28.40
7	F-311	36.66
8	F-403	43.33
9	F-415	41.42
10	F-477	48.88

Cd1=6.62

Data regarding G.F.Y indicated that a new promising line of Oat F-417 gave maximum G.F.Y (50-66t/ha) followed by F-477 which gave 48.88t/ha G.F.Y under water stress condition.

EFFECT OF LAST CUTTING ON SEED PRODUCTION OF BERSEEM SUPER LATE & CHENAB.

This agronomic trial was conducted to find out the most suitable date of last cut of Berseem super late & Chenab when left for seed production. Five different date of last cut were selected. The system of lay out was split plot with 3 replication having plot size of 3x5m.Data regarding seed yield is given below.

Date of last cut	Seed Yield kg/Acre	
	Super late	Chenab
31st March	290	280
8th April	270	260
16th April	205	200
24th April	165	160
1st May	115	110

Cd1=6.70

Data regarding seed production revealed that super late & Chenab, Berseem gave maximum seed production when left for seed production on 31st March which gave 290 & 280kg/Acre seed respectively.

SOIL SCIENCE

NUTRITIONAL QUALITY ASSESSMENT OF KHARIF FODDERS

10 line of each crop of kharif season like sorghum, pearl millet and maize were selected for the quality analysis. Samples were collected at critical stage of each crop. The analysis was done by the biochemistry section of AARI, Faisalabad. The quality data is given below

PEARL MILLET

S No.	Varieties / Lines	Dry Matter (%)	Ash (%)	Crude Fat (%)	Crude Protein (%)	Crude Fiber (%)	NFE (%)
1	TIFT 85 D	18.1	10.4	3.29	9.63	21.8	54.8
2	Composite-III	18.1	10.3	3..89	9.45	20.6	55.7
3	PM01016	18.4	9.53	4.00	8.75	19.4	58.3
4	Sargodha Bajra 2011	15.6	10.5	3.88	9.10	23.0	53.5
5	Sen POP	17.8	10.5	3.25	9.98	20.7	55.5
6	H 72	18.2	10.6	3.34	9.28	21.8	54.9
7	DP Pak	17.0	10.4	3.87	8.93	22.8	53.9
8	TIFT 383	15.0	10.5	4.08	10.2	21.8	53.5
9	Q Bajra	16.4	9.89	3.84	9.10	20.0	57.2
10	No.7703	18.8	9..50	3.86	9.10	20.0	57.5
11	CZK923	17.8	11.3	3.99	9.28	23.0	52.5
12	G White	19.0	10.8	3.84	9.10	20.7	55.6
13	BS-2000	19.3	10.0	3.72	8.79	21.4	56.1
Range		15.5 to 19.5	9.5 To 11.5	3.25 To 4.00	9 To 10	19.5 To 23	53 To 57

SORGHUM

S No.	Varieties / Lines	Dry Matter (%)	Ash (%)	Crude Fat (%)	Crude Protein (%)	Crude Fiber (%)	NFE (%)
1	Advance V1	24.0	9.72	2.57	7.26	28.0	47.6
2	Advance V2	22.8	9.80	2.95	7.44	29.5	49.7
3	Advance V3	26.3	9.60	2.79	7.53	31.3	51.2
4	Advance V4	24.3	9.3	3.20	7.88	30.5	50.6
5	Advance V5	22.8	9.36	2.99	8.31	31.0	51.6
6	Advance V6	17.5	8.20	2.98	8.73	24.7	44.6
7	Advance V7	24.3	9.32	2.85	8.23	22.8	43.2
8	Advance V8	25.5	9.50	3.11	7.39	24.0	44.0
9	Zonal V1	19.5	9.51	2.98	7.93	21.8	42.2
10	Zonal V2	26.1	9.99	3.27	7.74	23.3	44.3
11	Zonal V3	26.0	9.31	3.17	7.00	23.9	43.4
12	Zonal V4	26.5	9.01	2.91	7.21	23.0	42.1
Ranges		17.5 To 26.5	9 To 10	2.5 To 3.5	7 To 9	21 To 31	42 To 51

MAIZE

S.No.	Varieties / Lines	Dry Matter (%)	Ash (%)	Crude Fat (%)	Crude Protein (%)	Crude Fiber (%)	NFE (%)
1	C-706	16.8	7.61	2.95	14.4	27.1	48.0
2	Pak 2	17.1	8.33	2.74	14.0	26.1	48.8
3	AWL 2002	15.5	9.21	2.90	11.4	27.3	49.2
4	Golden	18.0	8.70	2.40	12.1	25.4	51.4
5	Malka	16.4	9.53	2.94	11.9	28.9	46.8
6	Pearl	16.9	9.91	3.64	12.4	24.1	49.9
7	MMRI	16.4	9.11	2.47	13.1	22.3	53.0
8	Ag 85	17.6	8.54	2.49	13.1	24.0	51.9
9	Ag 2002	16.2	8.51	2.36	14.4	24.0	50.8
10	No. 1501	24.4	9.69	2.61	13.7	24.0	50.1
11	P 1	24.0	6.97	2.40	12.3	22.5	55.8
12	Advanced P1	22.4	6.27	2.13	12.8	29.2	49.6
13	Advanced P2	21.8	6.65	2.72	13.1	26.4	51.1
14	Advanced P4	23.0	7.00	2.03	12.4	28.7	49.9
15	Advanced P5	23.1	7.11	2.38	11.7	28.7	50.1
Range		15.5 To 24	7 To 10	2 To 3.5	11.5 To 14.5	22 To 29	46 To 55

PERFORMANCE EVALUATION OF PEARLMILLET GERMPLASM ON SALT AFFECTED SOIL

The trial was conducted to find out the most tolerant line/variety of pearl millet. Trial was conducted at Soil Salinity Research Institute, Pindi Bhattian. Ten lines of pearl millet were tested in RCBD with 5 replications having plot size 1.8x5 m. the data is given below.

Soil Analysis Before Sowing

Soil Texture	ECe $mScm^{-1}$	pH	OM %	P_2O_5 mg/kg	K_2O mg/kg
Clay loam	5.11	9.1	0.76	7.6	146

Treatments	Lines	Germination %age (m^{-2})	Mortality % (m^{-2})	GFY t ha^{-1}
Comparatively Salt Tolerant				
T8	CZK-923	88	8	24.51
T6	RCBK-948	87	9	23.96
T11	Sgd Bajran2011	84	11	23.28
T9	Q-Bajra	81	12	22.63
Medium Salt Tolerant				
T5	Gj-Bajra	74	23.4	20.70
T4	Wt-Bajra	73	27.1	17.09
T2	Composite-II	72	28.3	17.01
T12	MB-87	67	31	12.30
T3	Composite-IV	65	32.3	11.69
Salt Sensitive Lines				
T7	Y-84	26	52.1	5.90
T10	BS-2000	16	54.8	4.24
T1	Composite-I	12	58.1	4.04

PERFORMANCE EVALUATION OF SORGHUM GERMPLASM ON SALT AFFECTED SOIL

The trial was conducted to find out the most tolerant line/variety of sorghum. Trial was conducted at Soil Salinity Research Institute, Pindi Bhattian. Twelve lines of pearl millet were tested in RCBD with 5 replications having plot size 1.8x5 m. the data is given below.

Soil Analysis Before Sowing

Soil Texture	ECe $mScm^{-1}$	pH	OM %	P_2O_5 mg/kg	K_2O mg/kg
Clay loam	5.04	9.2	0.76	7.4	154

Treatments	Lines	Germination %age(m^{-2})	Mortality % (m^{-2})	G.F.Y t ha^{-1}
Comparatively Salt Tolerant				
T1	YS-98	72	16	24.8
T5	Hegari	71.1	19.3	24.4
T10	PVK-801	70.6	19.9	23.9
T12	S-145	68.2	21.3	22.1
Medium Salt Tolerant				
T2	Sgd-013-1	52.6	47.9	18.6
T7	No.1572	47.3	48.3	18.3
T6	JS-2002	46.9	49.7	17.7
Salt Sensitive				
T3	Sgd-013-2	24	51	11.8
T11	FRI-07	20.8	52.4	11.2
T8	No.80010	17.2	52.9	11.1
T9	I-6	15.7	54.1	9.09
T4	Sorghum-2011	14.7	54.4	7.88

STANDERDIZATION OF N & P FERTILIZERS FOR MAXIMUM GREEN FODDER YIELD OF MAIZE LINE 1501

To find out the best combination of N & P fertilizers for obtaining maximum green fodder yield of maize. The trial was conducted in RCBD plan with 3 replications and 10 treatments level of N.P.K levels. Data was recorded at 50 % flowering . the results are given below.

Soil Analysis Before Sowing

Soil Texture	ECe $mScm^{-1}$	pH	OM %	P_2O_5 mg/kg	K_2O mg/kg
Clay loam	0.78	7.4	0.69	6.5	137

Treatments NPK (kg /ha)	Green Fodder Yield t/ha	Dry Matter %	MRR
T_1 00-00-25	48.89	18.10	--
T_2 75-65-25	51.07	18.27	0.57
T_3 75-80-25	51.47	18.43	0.60
T_4 75-95-25	52.89	18.47	0.82
T_5 90-65-25	54.62	19.50	1.38
T_6 90-80-25	61.48	19.73	2.71
$T_7$90-95-25	59.44	18.70	2.03
$T_8$105-65-25	56.47	18.40	1.69
T_9 105-80-25	54.63	18.27	1.15
T_{10} 105-95-25	55.19	18.60	1.14

STANDERDIZATION OF N & P FERTILIZERS FOR MAXIMUM GREEN FODDER YIELD OF SORGHUM LINE SS-9901

To find out the best combination of N & P fertilizers for obtaining maximum green fodder yield of sorghum. The trial was conducted in RCBD plan with 3 replications and 10 treatments level of N.P.K levels. Data was recorded at 50 % flowering . the results are given below.

Treatments NPK(kg /ha)	Fodder Yield t/ha	Dry Matter %	MRR
T_1 Control	53.27	17	--
T_2 60-25-25	50.27	17.1	0.26
T_3 60-50-25	54.05	17.2	0.32
T_4 60-75-25	54.38	17.3	0.38
T_5 80-25-25	54.77	17.3	0.78
T_6 80-50-25	55.83	17.3	1.21
$T_7$80-75-25	57.88	17.2	1.05
$T_8$100-25-25	57.72	17.2	0.95
T_9 100-50-25	56.72	17.6	0.67
T_{10} 100-75-25	56.05	17.1	0.49

STANDERDIZATION OF N & P FERTILIZERS FOR MAXIMUM GREEN FODDER YIELD OF PEARL MILLET LINE (COMPOSITE-II)

To find out the best combination of N & P fertilizers for obtaining maximum green fodder yield of pearl millet. The trial was conducted in RCBD plan with 3 replications and 10 treatments level of N.P.K levels. Data was recorded at 50 % flowering . the results are given below.

Soil Analysis Before Sowing

Soil Texture	ECe ($mScm^{-1}$)	pH	OM %	P_2O_5 (mg/kg)	K_2O (mg/kg)
Clay loam	0.72	7.4	0.67	6.0	133

Treatments (NPK kg /ha)	Fodder Yield t/ha^{-1}	Dry Matter %	MRR
T_1 00-00-25	45.92	16.80	
T_2 50-30-25	53.7	17.03	2.67
T_3 50-60-25	54.07	17.13	2.59
T_4 50-90-25	54.26	17.33	2.81
T_5 70-30-25	54.36	17.47	3.29
T_6 70-60-25	56.07	17.84	2.84
$T_7$70-90-25	53.7	17.47	2.70
$T_8$90-30-25	53.89	17.61	2.64
T_9 90-60-25	54.07	17.72	2.03
T_{10} 90-90-25	54.44	17.70	1.69

PLANT PROTECTION

SCREENING OF SORGHUM GERMPLASM AGAINST RED LEAF SPOT

The seed of Sorghum germplasm entries were sown in two lines of 3 meter length. The crop was raised adopting standard agronomic practices. Disease incidence data recorded at maturity.

The observation recorded by the data is given below.

S. No.	Reaction	No. of Varieties/lines
1	Resistant (R)	0
2	Moderately Resistant (MR)	19
3	Moderately Susceptible (MS)	46
4	Susceptible (S)	50
5	Highly Susceptible (HS)	0
	Total	115

GUAR BREEDING RESEARCH STATION, BAHAWALPUR

1. GUAR[*Cyamposis tetragonoloba* (L.) Taub]

1.1 BREEDING STUDIES

1.1.1. COLLECTION, EVALUATION AND MAINTENANCE OF GUAR GERMPLASM

An experiment consisting of 648 genotypes/accessions of guar including three checks was sown on 16.06.2019 according to Augmented Design. The experiment was harvested during November, 2019. The genotypes/ accessions of guar were evaluated and maintained under close observation and a wide range of values for various characteristics was observed in all the genotypes. Seed of the accessions/genotypes was harvested on maturity and was preserved for further studies. Data on various traits were recorded and results are given as under:

Table 1: Results of the Trial Evaluation & Maintenance of Guar Germplasm

Sr. No.	Characters	Range
1	Days to 50% flowering	45-65 days
2	Days to 90% maturity	110-180 days
3	Plant height	60-220 cm
4	Branches plant^{-1}	0-18
5	Clusters plant^{-1}	10-32
6	Pods plant^{-1}	30-420
7	Pods cluster^{-1}	3-14
8	Pod length	2-8cm
9	Grains pod^{-1}	3-10
10	1000-Grain weight	20-40gm
11	Green fodder yield	15-35 tons ha^{-1}
12	Grain Yield	500-2600 Kg ha^{-1}

Figure 1: Evaluation and maintenance of guar germplasm

1.1.2. HYBRIDIZATION OF GUAR AND STUDY OF FILIAL GENERATIONS

To combat biotic (insect pests/ diseases), abiotic stresses (drought) and to improve grain and fodder yield, hybridization programme was undertaken by crossing guar genotypes.As flower of guar plant is very minute, it is very difficult to get artificial crossing successful. Despite this fact, following 12 fresh crosses were attempted:

Table 2: Hybridization of Guar

Cross #	Name of Cross	No. of Crosses attempted	No. of successful pods harvested
1.	S-6384 X BR-2017	98	2
2.	BR-2017 X S-6384	77	-
3.	S-5823 X S-6384	96	1
4.	S-6161 X S-5823	94	-
5.	S-6558 X BR-2017	83	-
6.	BR-2017 x BR-90	86	-
7.	BR-90 X BR-2017	113	-
8.	BR-90 x S-5823	103	3
9.	S-5823 X BR-90	94	-
10.	BR-90 X S-6036	115	-
11.	S-6036 X BR-99	119	-
12.	BR-99 X S-6036	93	-

F_0 seed was harvested for growing F_1 during Kharif, 2020.

Following generations were maintained during Kharif, 2019:

Generation	Parental Crosses/progenies studied	crosses/plants/ progenies selected
F_1	3 (Crosses)	2 (Crosses)
F_2	3 (Crosses)	40 (Plants)
F_3	6 (Progenies)	5 (Plants)

Figure2: Hybridization of guar is in progress

1.1.3 IRRADIATION OF GUAR SEED TO CREATE GENETIC VARIABILITY

The seed of two advance lines of guarS-6384 and S-6161was sent to NIAB, Faisalabad for its treatment with radiations at 05different dozes i.e. 10Kr, 20Kr, 30Kr, 40Kr and 50Kr. After irradiation process, 10 mutants (05 of each guar line) were received from NIAB, Faisalabad. The radiated seed of above varieties were sown on 15.06.2019 to raise M_1 Generation. Out of these 10 Mutants, 04 were selected to raise M_2 generation during Kharif, 2020.

Figure 3: Irradiation Trial of Guar

1.1.4 IDENTIFICATION OF PROMISING PROGENY LINES OF GUAR

An experiment consisting of 65 progenies and 50 superior progenies alongwith two checks was sown on 15.06.2019. The similar agronomic practices were adapted throughout the growth period. The experiment was harvested during November, 2019. On the basis of good performance 18 superior progenies were selected for their evaluation in preliminary yield trials during Kharif, 2020. Furthermore, 60 new single plants were selected from available guar material to grow plant to progeny rows during Kharif, 2020.

	Single plants/progenies studied	**Single plants/progenies selected**
Selection of Single plants	-	60 (plants)
Selection of Superior progenies	65 (progenies)	40 (plants)
Final selection of better performing progenies for evaluation in preliminary yield trials during Kharif, 2020.	50 (progenies)	18 (progenies)

Table 3: Previous Year Results

1.1.5 PRELIMINARY GUAR YIELD TRIALS

1.1.5.1PRELIMINARY GUAR YIELD TRIAL-I (A-I)

A-I trial consisting of 09 strains including one check was sown on 14.06.2019. The experiment was laid out according to RCBD having 4 repeats and plot size of 2.7m x 7.2m. The similar agronomic practices were adapted for all the entries throughout the growth period. The experiment was harvested during November, 2019 and yield data were recordedwhich are given as under:

Table4: Results of Preliminary Guar Yield Trial -I (A-1)

Strains	**Grain yield (Kg ha^{-1})**	**± % over check**
S-6683	2834	22.00
S-6688	2646	13.90
S-6701	2627	13.09
S-6686	2488	7.10
S-6682	2332	0.39
BR-2017 (Check)	**2323**	0.00
S-6693	1982	-14.68
S-6675	1790	-22.94
S-6697	1415	-39.09
LSD (0.05)	293	

Figure 5: Preliminary Guar Yield Trial -I

The data showed that strain S-6683 gave the maximum grain yield of 2834kg ha^{-1} (22.00% higher than check)followed by the strain S-6688 which gave the yield of 2646kg ha^{-1}. The strains S-6693, S-6675 and S-6697were the lowest yielders (1415-1982kg ha^{-1}) than the check variety BR-2017 (2323kg ha^{-1}). Five strains out yielded the check variety BR-2017 by 0.39% to 22.00% and were selected for evaluation in B-trials during the year 2020 on the basis of good performance. Highly significant differences were found among the mean values of the genotypes.

1.1.5.2 PRELIMINARY GUAR YIELD TRIAL -II (A-II).

A-II trial consisting of 08 strains including one check was sown on 14.06.2019. The experiment was laid out according to RCBD having 3 repeats and plot size of 2.7m x 7.2m. The similar agronomic practices were adapted for all the entries throughout the growth period. Theexperiment was harvested during August, 2019 for fodder yield and November, 2019 for grain yield and yield data were recorded which are given as under:

Table: 5 Results of Preliminary Guar Yield Trial -II (A-II)

Strains	Grain yield (Kg ha^{-1})	± % over check	Fodder Yield tha^{-1}	± % over check
S-6695	**2658**	85.87	34.47	26.45
S-6719	2418	69.09	**35.49**	30.19
S-6692	2143	49.86	33.26	22.01
S-6710	1807	26.36	33.78	23.92
S-6698	1783	24.69	28.88	5.94
BR-90 (Check)	**1430**	**0.00**	**27.26**	**0.00**
S-6690	878	-38.60	22.87	-16.10
S-6715	737	-48.46	26.41	-3.12
LSD (0.05)	433.5		2.90	

As for as the grain yield is concerned, the strain S-6695 out yielded all the contestants and gave grain yield of 2658Kg ha^{-1} i.e. 85.87% higher than check variety BR-90 followed by the variety S-6719 which gave the yield of 2418Kg ha^{-1}. In case of fodder yield, strain S-6719 produced maximum fodder yield of 35.49 t ha^{-1} followed by S-6695 which gave 34.47 t ha^{-1}. The strains S-6695, S-6719, S-6692, S-6710 and S-6698 gave 24.69% to 85.87% higher grain yield and 5.94% to 26.45% higher fodder yield than the check variety BR-90. On the basis of good performance five strains S-6695, S-6719, S-6692, S-6710 and S-6698 were selected for further evaluation in B-trials during the year 2020. Statistical analysis revealed highly significant differences among the mean values.

Figure 6: Preliminary Guar Yield Trial -II

1.1.6 REGULAR GUAR YIELD TRIAL (B-Trial)

B-trial consisting of 15 strains including one check was sown on 14.06.2019. The experiment was laid out according to RCBD having 4 repeats and plot size of 2.7m x 7.2m. The similar agronomic practices were adapted for all the entries throughout the growth period. The experiment was harvested during August, 2019 for fodder yield and November, 2019 for grain yield to record yield data which are given as under:

Table: 6 Results of Regular Guar Yield Trial

Strains	Grain yield (Kg ha^{-1})	± % over check	Fodder Yield(t ha^{-1})	± % over check
S-6642	**3079**	40.02	34.13	8.76
S-6668	2855	29.83	32.59	3.86
S-6669	2726	23.97	**36.19**	15.33
S-6636	2438	10.87	31.38	0.00
S-6666	2310	5.05	34.29	9.27
S-6637	2215	0.73	33.98	8.29
BR-2017 (Check)	**2199**	**0.00**	**31.38**	**0.00**
S-6638	2006	-8.78	33.95	8.19
S-6663	1762	-19.87	29.30	-6.63
BR-90 (Check)	**1458**	-33.70	**29.32**	-6.56
S-6673	1235	-43.84	25.59	-18.45
S-6655	1016	-53.80	25.90	-17.46
S-6671	900	-59.07	18.78	-40.15
S-6625	751	-65.85	16.28	-48.12
LSD(0.05)	230.65		1.8	

In case of grain yield, the strain S-6642 out yielded all the contestants and gave grain yield of 3079Kg ha^{-1}i.e. 40.02% higher than check variety BR-2017 followed by the strains S-6668which produced the yield of 2855Kg ha^{-1} than check variety BR-2017 (2199kg ha^{-1}). First six strains gave 0.73% to 40.02% higher grain yield than the check variety BR-2017. As for as the fodder yield is concerned, strain S-6669 produced maximum fodder yield of 36.19 tha^{-1} followed by S-6666 which gave 34.29 tha^{-1} than check variety i.e. BR-2017 (31.38 tha^{-1}). On the basis of good performance, six strains S-6642, S-6668, S-6669, S-6636, S-6666 and S-6637were selected for further evaluation in C-trials during the year 2020. Statistical analysis revealed highly significant differences among the mean values.

Figure 7: Regular Guar Yield Trial

1.1.7 ADVANCE GUAR YIELD TRIAL (C-Trial)

An experiment consisting of 7 strains including two checks was sown on 14.06.2019. The experiment was laid out according to RCBD having 4 repeats and plot size of 2.7m x 7.2m. The similar agronomic practices were adapted for all the entries throughout the growth period. The experiment was harvested during August, 2019 for fodder yield and November, 2019 for grain yield to record yield data which are given as under:

Table: 7 Results of Advance Guar Yield Trial

Strains	Grain yield (Kg ha^{-1})	± % over check	Fodder Yield (t ha^{-1})	± % over check
S-6547	**2713**	22.65	37.04	9.52
S-6536	2688	21.52	27.96	-17.33
S-6543	2649	19.76	31.25	-7.60
S-6560	2559	15.69	**37.42**	10.64
BR-2017 (Check)	**2212**	**0.00**	**33.82**	**0.00**
S-6553	1890	-14.56	30.16	-10.82
S-6260	1569	-29.07	23.15	-31.55
BR-90 (Check)	1222	-44.76	30.20	-10.70
LSD(0.05)	185.22		2.08	

The strain S-6547 produced maximum grain yield of 2713Kg ha^{-1} and out yielded all the contestants followed by the strain S-6536 which gave grain yield of 2688Kg ha^{-1} than check variety BR-2017 (2212Kg ha^{-1}). As for as the fodder yield is concerned, strain S-6560produced maximum yield of 37.42 tha^{-1} followed by S-6547which gave 37.04 tha^{-1} than check variety BR-2017 (33.82 tha^{-1}). The four strains S-6547, S-6536, S-6543 and S-6560 produced 15.69-22.65% higher grain yield than check BR-2017 while two strains S-6547 and S-6560 produced 9.52-10.64% highertha^{-1}fodder yield than check variety. On the basis of

good performance, these four strains were selected for further evaluation during the year 2020 in Zonal Varietal Trial. Statistical analysis revealed highly significant differences among the mean values.

Figure 8Advance Guar Yield Trial

1.1.8 ZONAL GUAR YIELD TRIAL

An experiment consisting of 05 strains including one check was sown at 3 locations at Govt. farms in Punjab. The experiment was laid out according to RCBD having 4 repeats and plot size of 2.7m x 7.2m. The experiment was harvested during November, 2019 to record grain yield data. The results received are summarized as under:

Table: 8 Results of Zonal Guar Yield Trial

The data presented in the above table showed that guar strain S-6384 out yielded all the contestants and gave higher grain yield of 2439Kg ha^{-1} followed by S-6161 which gave 2091Kg ha^{-1} as compared to check variety BR-2017 (1828Kg ha^{-1}) on the basis of 3 locations average. The maximum grain yield (2939Kg ha^{-1}) was produced by S-6384 at ARS,

Varieties	**Grain Yield (Kg ha^{-1})**			**Average**
	Agronomic Research Station, KWL	**Agronomic Research Station, Karor**	**Agronomic Research Station, BWP**	
S-6384	2481	1897	2939	2439
S-6161	2010	1646	2617	2091
S-6159	2096	1456	2571	2041
BR-2017 (Check)	**1704**	**1633**	**2148**	**1828**
S-6165	1938	1359	1836	1711

Bahawalpur as compared to check (2148Kg ha^{-1}). The mean values differed significantly from one another.

1.1.9 NATIONAL UNIFORM YIELD TRIAL OF GUAR

Seed of 02 strains/varieties of guar was sent to Coordinator (Fodder), NARC, Islamabad to conduct National Uniform Guar Yield Trial. The Coordinator (Fodder) conducted the trial at following sites:

1. BARS, FatehJang 2. AZRI, Bahawalpur 3. AZRI, Bhakkar
4. AZRC, D.I.Khan 5. CRI, Khanpur

The trial was laid out in RCBD fashion with 3 repeats and plot size of 2.7m x 7.2m. The guar strains were given code numbers by Coordinator (Fodder) and were sent to testing sites. At the end of Kharif season, the decoded data were received from the Coordinator (Fodder). The data on grain yield are presented as under:

Table: 9 National Uniform Yield Trial of Guar

Entry Name	Grain Yield (Kg ha^{-1})					
	BARS FatehJang	**AZRI BWP**	**AZRI Bhakkar**	**AZRC D.I.Khan**	**CRI Khanpur**	**Av. All Sites**
S-6384	2675	2509	2754	1544	2777	2452
S-6161	2147	2384	2364	1366	2570	2166
BR-2017 (Check)	**2240**	**1625**	**2022**	**1234**	**1980**	**1820**
AZRC-G-192	1851	1597	1733	1344	1795	1664
AZRC-G-12	1768	1663	1670	1506	1611	1644
LSD (0.05)	330.6	234.36	282.77	144.53	109.57	-

The decoded data on grain yield received from the Coordinator (Fodder) revealed that strain S-6384 developed by this station, out yielded all the contestant varieties and secured first position by producing grain yield of 2452Kg ha^{-1}on the basis of average of five locations as compared to the check variety BR-2017 which produced 1820Kgha^{-1}. The Strain S-6161 which is also developed by this stationsecured 2ndposition and produced 2166Kg ha^{-1}grain yield.

1.1.10 EVALUATION OF ADVANCE LINES OF GUAR UNDER DROUGHT STRESS CONDITIONS

An experiment consisting of 05 strains including one check was designed to evaluate high yielding and better adapted varieties/lines of guar under drought stress conditions for areas experiencing water shortage. The experiment was sown on 14.06.2019. The experiment was laid out according to RCBD having 4 repeats and plot size of 2.7m x 7.2m. No irrigation

was applied from sowing till harvesting except rowni. The experiment was harvested during November, 2019 and grain yield data were recorded which are given as under:

Table: 10 Results of Drought Stress Trial

Entry Name	Grain yield (Kg ha^{-1})	
	No irrigation a/f sowing	3 irrigations a/f sowing
S-6384	1910	3022
S-6161	1582	2834
S-6159	1415	2449
BR-2017	1595	2225
S-6165	1299	1993
LSD(0.05)	147.22	356.61

Under drought stress conditions, the variety S-6384 out yielded all the contestants and gave the maximum grain yield of 1910Kg ha^{-1}than check BR-217 (1595Kg ha^{-1}) while the strain S-6161was at par in grain yield with check BR-2017. Under irrigated conditions, i.e. 3-irrigations were applied after sowing, the strain S-6384 gave maximum grain yield of 3022Kgha^{-1} followed by S-6161 and S-6159 which produced 2834kgha^{-1} and 2449Kgha^{-1}, respectively. It is concluded that strains S-6384, S-6161 and check BR-2017 can be better adapted to the drought stress conditions and can produce better grain yield. The mean values differed significantly from one another.

1.2 AGRONOMIC STUDIES

1.2.1 ROW SPACING TRIAL ON GUAR

An experiment consisting of a guar strain S-6384 and a check (BR-2017) was laid out in Spilt Plot Design with 4 repeats and plot size of 1.8m x 2.7m during Kharif, 2019 to investigate the effect of 3 row spacings i.e. 30, 45 and 60 cm on grain yield of guar. The similar agronomic practices were adapted for all the varieties/treatments throughout growth period. The data on grain yield were recorded and are given as under:

Table:11 Results of Row Spacing Trial of Guar

Treatments	Row Spacing (cm)	varieties	
		BR-2017	**S-6384**
T1	30	1903	2127
T2	**45**	**2243**	**2755**
T3	60	1881	2253
LSD (0.05)	V=269.5	RS=337.26	

The data recorded illustrated that the crop planted on 45cm row spacing gave higher grain yield. The strain S-6384 produced grain yield of 2755Kgha^{-1} and BR-2017 produced 2243Kgha^{-1}while increase or decrease in row spacing 30cm to 60 cm resulted in decreased yield. Statistical analysis revealed significant differences among the mean values.

Figure 9: Row Spacing Trial on Guar

1.2.2 RESPONSE OF GUAR STRAINS TO NITROGEN & PHOSPHORUS FERTILIZERS FOR GRAIN YIELD

An experiment consisting of a guar strain S-6384 and a check (BR-2017) was laid out in Spilt Plot Design with 3 repeats and plot size of 1.8m x 2.7m during Kharif, 2019 to find out the optimum dose of N & P fertilizer to obtain maximum grain yield. Ten treatments of N x P fertilizers were applied as mentioned in the table below. The similar agronomic practices were adapted for all the varieties/treatments throughout growth period. The data on grain yield were recorded and are given as under:

Table:12 Results of N& P Fertilizer Trial of Guar

Treatments	N (Kg ha^{-1})	P (Kg ha^{-1})	Variety	
			BR-2017	S-6384
T1	0	0	1462	1620
T 2	15	30	1642	1859
T 3	15	60	1768	2067
T 4	15	90	1904	2292
T 5	30	30	1716	2511
T 6	**30**	**60**	**2467**	**2712**
T 7	30	90	2310	2631
T 8	45	30	2054	2080

T9	45	60	1956	2420
T10	45	90	1763	1800
LSD (0.05)	**V=401**	**NP=250**	**V*NP=489**	

The data revealed that both the varieties S-6384 and check BR-2017 produced maximum grain yield of 2712 and 2764Kg ha^{-1}, respectively, at fertilizer doze of N 30 Kg ha^{-1} and P 60 Kg ha^{-1}. Further increase or decrease in fertilizer's doses resulted in decrease of grain yield. Statistical analysis revealed significant differences among the mean values.

1.2.3 RESPONSE OF GUAR STRAINS TO POTASH FERTILIZER FOR GRAIN YIELD

An experiment consisting of two guar strains/varieties i.e. BR-2017and S-6384 was laid out in Spilt Plot Design with 4 repeats and plot size of 1.8m x 2.7m during Kharif, 2019 to find out the optimum dose of K fertilizer to harvest maximum grain yield. Four treatments of K fertilizers were applied by keeping constant doze of N & P to ascertain the optimum doze of Kas mentioned in the table below. The similar agronomic practices were adapted for all the varieties/treatments throughout growth period. The data on grain yield were recorded and are given as under:

Table:13 Results of K Fertilizer Trial of Guar

Treatments	**Fertilizer Dose (Kg ha^{-1})**			**Grain Yield (Kg ha^{-1})**	
	N	**P**	**K**	**BR-2017**	**S-6384**
T1	30	60	0	1983	2038
T2	30	60	30	2095	2401
T3	**30**	**60**	**60**	**2347**	**2861**
T4	30	60	90	2271	2513
LSD (0.05)	V= 84.00K= 365.00 VxK= 384.00				

The data illustrated that both the varieties BR-2017 & S-6384 produced maximum grain yield of 2347 and 2861Kg ha^{-1}, respectively, at fertilizer (Potash) doze of 60 Kg ha^{-1}.

Figure 10: Potash Fertilizer Trial on Guar

1.2.4 EFFECT OF DIFFERENT SOWING DATES ON THE GRAIN YIELD OF NEW GUAR STRAINS

An experiment consisting of a guar strain S-6384 and a check (BR-2017) was laid out in Spilt Plot Design with 3 repeats and plot size of 1.8m x 2.7m during Kharif, 2019 to find out the optimum sowing dates for new guar strains to harvest maximum grain yield. The experiment was sown at six different sowing dates i.e. 01/05, 15/05, 01/06, 15/06, 01/07& 15/07. The similar agronomic practices were adapted for all thevarieties/treatments throughout growth period. The data on grain yield were recorded and are given as under:

Table: 14 Results of Sowing Date Trial of Guar

Treatments	Varieties	
	BR-2017	**S-6384**
T1 (01/05)	2270	2349
T 2 (15/05)	2281	2434
T 3 (01/06)	**2445**	**2850**
T 4 (15/06)	2388	2534
T 5 (01/07)	1796	1835
T 6 (15/07)	1465	1574
LSD (0.05)	V=145 SD=200	V*SD=321

The data revealed that both the varieties S-6384 and check BR-2017 produced maximum grain yield of 2850Kg ha^{-1} and 2445Kg ha^{-1}, respectively, at sowing date of 1st June followed by experiment sown at 15th June. Further increase or decrease in sowing dates resulted in decrease of grain yield. Statistical analysis revealed significant differences among the mean values.

1.3 ENTOMOLOGICAL STUDIES

1.3.1 SCREENING OF GUAR GENOTYPES AGAINST INSECT PESTS

The seed of 05 strains of guar including one check was provided to the Entomologist, RARI, Bahawalpur during Kharif, 2019 for their screening against insect pests. The experiment was laid out according to RCBD with 3 replications and plot size of 2.7m x 7.2 m. The insect pest data were recorded and provided to this station which are given as under:

Table:15 Response of Guar Genotypes to Insect Pests

Entries	Average Jassid/Leaf	Average W.F./Leaf
S-6384	0.24	2.60
S-6161	0.28	2.40
S-6159	0.30	2.50
S-6165	0.33	3.36
BR-2017 (Check)	0.37	2.90
LSD 5%	0.35	1.90

The data received from the Entomologist revealed that only attack of white fly and jassid was observed. The strain S-6384 had minimum attack of jassid (0.24 leaf^{-1}) followed by S-6161 (0.28 leaf^{-1}) while BR-2017 had the highest infestation of jassid (0.37 leaf^{-1}). However, the attack was below ETL on all strains. The strain S-6161 had minimum infestation of whitefly (2.40 leaf^{-1}) followed by the strain S-6159 (2.50 leaf^{-1}) while S-6165 had maximum attack of white fly (3.36 leaf^{-1}). This shows better performance of all the strains against insect pest attack. The statistical analysis of the data revealed highly significant differences among the guar strains.

1.4 PATHOLOGICAL STUDIES

1.4.1 SCREENING OF GUAR STRAINS AGAINST DISEASES

The seed of 05 strains of guar along with one check was provided to the Plant Pathologist, RARI, Bahawalpur during Kharif, 2019 for their screening against diseases. The experiment was laid out according to RCBD with 3 replications and plot size of 2.7m x 7.2 m. The following results were reported by the Plant Pathologist, RARI, Bahawalpur:

Table:16 Results of Screening of Guar Genotypes against Diseases

Entries	**Bacterial blight and Alternaria blight** were observed and plant reaction was as under	
	Bacterial blight	**Alternaria blight**
S-6384	Moderately Resistant	Moderately Resistant
S-6159	Moderately Resistant	Moderately Resistant
S-6161	Moderately Susceptible	Resistant
S-6165	Moderately Susceptible	Moderately Resistant
BR-2017 (Check)	Moderately Resistant	Moderately Resistant

The Plant Pathologist, RARI, Bahawalpur reported that incidence of bacterial blight and alternaria blight was observed under Bahawalpur conditions. The results showed that S-6384 and S-6159 were moderately resistant to bacterial blight whileS-6161 and S-6165 were

moderately susceptible to this disease. In case of alternaria blight,the strain S-6161 was found resistant while all other strains including check were moderately resistant.

2 PEARL MILLET (*Pennisetum glaucum* L.)

2.1 ADAPTABILITY GREEN FODDER YIELD TRIAL ON PEARL MILLET

This trial was received from the Director, Fodder Research Institute, Sargodha during Kharif, 2019. The objective of the trial was to test the advanced varieties/lines of pearl millet in different ecological zones of the Punjab for their fodder yield and adaptability. The trial consisted of 06 coded varieties of pearl millet and was laid out according to RCBD with 3 replications and plot size of 1.8m x 5m and was sown on 25.07.2019. The data on fodder yield were recorded at the time of 50% flowering. The data recorded on green fodder yield are given as under:

Table:17 Results of Adaptability Trial of Pearl Millet

Entry	Green Fodder Yield(t ha^{-1})
A-V1	77.74
B-V2	80.73
C-V3	82.97
D-V4	79.23
E-V5	84.09
F-V6	76.62

The data were sent to the Director, Fodder Research Institute, Sargodha.

3 MAIZE (*Zea mays* L.)

3.1 ADAPTABILITY GREEN FODDER YIELD TRIAL OF MAIZE

This trial was received from the Director, Fodder Research Institute, Sargodha. The trial consisted of 07 coded varieties of maize and was laid out according to RCBD with 3 replications and plot size of 1.8m x 5m and was sown on 25.07.2019.The data recorded on green fodder yield at the time of 50% flowering are given as under:

Table:18 Results of Adaptability Green Fodder Yield Trial of Maize

Entry	Green Fodder Yield (t ha^{-1})
Composite-15	36.45
MS-05-17	45.56
MS-01-17	48.47
MS-03-17	48.84
FD-2020	46.10
Sgd.2002 (Check)	43.01
MMRI Yellow (Check)	41.19

The data were sent to the Director, Fodder Research Institute, Sargodha.

4 SORGHUM (*Sorghum bicolor* L.)

4.1 ADAPTABILITY GREEN FODDER YIELD TRIAL OF SORGHUM

An experiment consisting of 08 coded strains of sorghum was received from the Director, Fodder Research Institute, Sargodha. Trial was laid out according to RCBD with 3 replications and plot size of 1.8m x 5m and was sown on 25.07.2019.The data recorded on green fodder yield at the time of 50% flowering are given as under:

Table: 19 Results of Adaptability Trial of Sorghum

Entry	Green Fodder Yield (t ha^{-1})
A-V1	63.58
B-V2	69.99
C-V3	80.73
D-V4	66.66
E-V5	51.10
F-V6	64.43
G-V7	69.25
H-V8	78.88

The data were sent to the Director, Fodder Research Institute, Sargodha

5 OATS(*Avena sativa* L.)

5.1 ADAPTABILITY GREEN FODDER YIELD TRIAL OF OATS

This trial was received from the Director, Fodder Research Institute, Sargodha during Rabi, 2019-20. The trial consisted of 12 coded varieties of oats. It was laid out according to RCBD with 3 replications and plot size of 1.8m x 8m and was sown on 12.11.2019.The data on green fodder yield were recorded at the time of 50% flowering and are given as under:

Table:20 Results of Adaptability Green Fodder Yield Trial of Oats

Varieties	Green Fodder Yield (t ha^{-1})
A	75.56
B	75.11
C	68.44
D	77.33
E	75.56
F	72.67
G	82.22
H	78.22
I	66.22
J	72.22
K	77.11
L	78.89

The data recorded were sent to the Director, Fodder Research Institute, Sargodha.

5.2 ADVANCE GREEN FODDER YIELD TRIAL OF OATS

This trial was received from the Director, Fodder Research Institute, Sargodha during Rabi, 2019-20. The trial consisted of 10 coded varieties of oats. It was laid out according to RCBD with 3 replications and plot size of 2.4m x 8m and was sown on 12.11.2019.The data on green fodder yield were recorded at the time of 50% flowering and are given as under:

Table:21 Results of Adaptability Green Fodder Yield Trial of Oats

Varieties	Green Fodder Yield (t ha^{-1})
A	77
B	73
C	64
D	52
E	53
F	48
G	50
H	50
I	49
J	53

The data recorded were sent to the Director, Fodder Research Institute, Sargodha.

6. BERSEEM(*Trifoliumelexandrinum*L.)

6.1 ADAPTABILITY GREEN FODDER YIELD TRIAL OF BERSEEM

This trial was received from the Director, Fodder Research Institute, Sargodha. The trial consisted of 7 coded varieties of Berseem and was laid out according to RCBD with 3

replications and plot size of 3m x 5m. It was sown on 14.11.2019. The green fodder yield data were recorded for three times and compiled data are presented as under:

Table: 22 Results of Adaptation Fodder Yield Trial of Berseem

Varieties	Green Fodder Yield (t ha^{-1})
A	40.82
B	43.89
C	44.33
D	44.15
E	44.73
F	46.30
G	45.24

The compiled/coded data were sent to the Director, Fodder Research Institute, Sargodha.

6.2 NATIONAL UNIFORM FODDER YIELD TRIAL OF BERSEEM

An experiment consisting of Six entries (1-6) of Berseem was received from the Coordinator (Fodder), PARC, Islamabad. Trial was laid out according to RCBD with 3 replications and plot size of 3m x 5m and was sown on 14.11.2019. The data on fodder yield were recorded. The Lucerne strains were harvested forthree times and the compiled data are given as under:

Table:23Results of National Uniform Fodder Yield Trial on Lucerne

Entries No.	Fodder Yield (t ha^{-1})
1	38.2
2	34.3
3	27.5
4	26.1
5	29.3
6	30.0

The coded data were sent to the Coordinator (Fodder), PARC, Islamabad.

7 LUCERNE(*Medicago sativa* L.)

7.1 NATIONAL UNIFORM FODDER YIELD TRIAL OF LUCERNE

An experiment consisting of three entries (E1, E2, E3)) of Lucerne was received from the Coordinator (Fodder), PARC, Islamabad. Trial was laid out according to RCBD with 3 replications and plot size of 1.5m x 5m and was sown on 14.11.2019. The data on fodder

yield were recorded. The Lucerne strains were harvested forfive times and the compiled data are given as under:

Table:24 Results of National Uniform Fodder Yield Trial on Lucerne

Varieties	Fodder Yield (t ha^{-1})
E1	61.6
E2	59.3
E3	68.9

The coded data were sent to the Coordinator (Fodder), National Agricultural Research Centre, Islamabad.

7.2 ADAPTABILITY TRIAL ON LUCERNE

This trial was received from the Director, Fodder Research Institute, Sargodha. The trial consisted of 8 coded varieties of Lucerne (V1 to V7) and was laid out according to RCBD with 3 replications and plot size of 1.8m x 5m. It was sown on 14.11.2019. The green fodder yield data were recorded for five times and the compiled data are given as under:

Table:25 Results of National Uniform Fodder Yield Trial on Lucerne

Varieties	Fodder Yield (t ha^{-1})
V1	64.0
V2	65.2
V3	52.3
V4	43.7
V5	57.3
V6	64.8
V7	57.8
V8	61.5

The compiled data were sent to the Director, Fodder Research Institute, Sargodha.

8. SEED PRODUCTION OF FODDER CROPS

This research station is producing the breeder nucleus seed (BNS) and pre-basic seed of fodder crops like guar, lucerne, berseem, oats and sorghum to meet the requirement of seed companies/growers/farmers of the southern Punjab. During the year 2019-20, the following quantity of seed was produced:

Table:26 Seed production of different fodder crops

Crop	Variety	BNS (kg)	Pre-basic (kg)	Total
Guar	BR-99	20	250	**270**
	BR-2017	60	630	**690**
Sorghum	Sorghum-2011	-	1200	**1200**
Berseem	Berseem Agaitti	-	500	**500**
	Punjab Berseem	-	550	**550**
Lucerne	Sargodha Lucerne	-	350	**350**
Oat	Sgd. Oats-2011	-	2200	**2200**

Figure 10: Seed Crop of Guar& Lucerne

AGRONOMIST (FORAGE PRODUCTION) AARI, FAISALABAD

EFFECT OF PLANTING METHODS ON GREEN FODDER YIELD OF DIFFERENT SORGHUM VARIETIES/ PROMISING LINES

The experiment was sown according to treatments with recommended seed rate @ 80kg/ha and fertilizer dose (NPK80-60-25 kg ha-1) having plot size 3m × 6m in split plot design with 3 replications. All agronomic practices were kept uniform. Data regarding plant height, number of leaves per plant, number of plants/m2 and green fodder yield etc was recorded. The results are given below.

Variety/lines / **Sowing Methods**	**Green Fodder Yield (t/ha)**			
	Sorghum-2011	**K-94**	**PVK-801**	**Means**
Broadcast	50.40 c	56.50 b	47.40 d	51.43 ab
Broadcast with Furrows	56.70 b	60.80 a	50.90c	56.13 a
Line sowing	46.20 d	49.40 cd	44.60 e	46.73 b
Means	51.10 b	55.57 a	47.63 c	
LSD for Varieties = 2.214, Sowing Methods = 5.989, Interaction = 3.835				

FODDER YIELD AND QUALITATIVE RESPONSE OF PEARL MILLET PLANTED ALONE AND IN MIXTUR WITH GUAR AND COWPEA

The experiment was sown by broadcast method with recommended fertilizer dose (NPK80-60-25kg ha^{-1}) having plot size 3m × 6m in RCBD with 3 replications. All Agronomic practices were kept uniform. Data regarding plant height, number of plants/m^2, green fodder yield, TDN, Crude Protein, crude fiber and ash % etc. was recorded. Results are given below.

Treatments	Green Fodder Yield (t/ha)	Crude Protein (%)
T1 = Pearl Millet alone	79.63 a	09.04
T2 =Guar alone	28.98 e	18.67
T3= Cowpea alone	21.52 f	15.17
T4 = Pearl millet (50%) + Guar (50%)	77.22 b	12.83
T5= Pearl millet (50%) + cowpea (50%)	65.18 d	10.50
T6 = Pearl millet (50%) + Guar (25%) + Cowpea (25%)	70.04 c	14.29
LSD value for GFY= 2.362		

EFFECT OF PLANTING TIME OF MAIZE LINE 1501 ON MAXIMUM GREEN FODDER YIELD

The experiment was sown according to the treatments with recommended seed rate 100kg/ha and fertilizer dose (NPK120-80-25kg ha^{-1}) having plot size 3m × 6m in RCBD with 3 replications. All Agronomic practices were performed. Data regarding plant height, number of leaves per plant, number of plants/m^2 and green fodder yield was recorded. Effect of the different treatments is explained below.

Treatments	Green Fodder Yield (t/ha)
T1 = 1st June	39.33 d
T2 = 15th June	42.60 c
T3 = 1st July	44.00 c
T4 = 15th July	50.60 a
T5 = 1st August	46.83b
LSD value for GFY = 2.774	

EFFECT OF SOWING TIME OF SORGHUM ON GREEN FODDER YIELD

The experiment was sown according to treatments with recommended seed rate @ 80kg/ha and fertilizer dose (NPK80-60-25 kg ha^{-1}) having plot size 3m ×6m in RCBD with 3 replications. All agronomic practices were performed. Data regarding plant height, number of

leaves per plant, number of plants/m^2 and green fodder yield was recorded. Outcomes of the experiment are given below.

Treatments	Green Fodder Yield (t/ha)
T_1= 15th June	56.66 a
T_2= 30th June	52.45 b
T_3= 15th July	51.48 b
T_4= 30th July	39.53 d
LSD Value for GFY=3.231	

ADAPTABILITY TRIAL OF COWPEAS

The experiment was sown according to the treatments in RCBD with 4 replications. All Agronomic practices were kept uniform. Data regarding green fodder yield was recorded.

Treatments	Green Fodder Yield (t/ha)
V_1=CP-383	36.043 a
V_2=CP-271	29.305 c
V_3=CP-162	25.035 e
V_4=CP-145	23.160 f
V_5=IT-552	23.160 f
V_6=CP-219	27.985 d
V_7=Cowpeas (Ravan-2003) Check	31.840 b
LSD value for GFY = 1.1074	

EFFECT OF DIFFERENT RATIONS ON MILK PRODUCTION IN BUFFALOES

Nine lactating buffaloes having similar lactation period and production were randomly selected from the dairy herd of this formation and each ration was fed to three buffaloes in each treatment. Data regarding daily milk yield /day, weight, milk composition (fat, protein and SNF) was recorded. The detail of ration fed to animals was consisted of following composition.

Ingredient	Rations No.1	Rations No.2	Rations No.3
Maize	46%	UAF Wanda	Anmol Wanda
Wheat	-		(L & DD)
Wheat bran	-		
Rice Polishing	20%		
Cotton seed cake	-		
Saroon seed cake	-		
Sun flower cake	20%		
Molasses	10%		
Sodium chloride	1%		
Di calcium Phosphate	2%		
Sodium bi carbonate	1%		
Total	**100**		

Data of average milk yield/animal/day(litre) obtained is given below.

Ration 1	Ration 2	Ration 3
10.35	9.10	9.50

DAIRY TECHNOLOGY DIVISION FODDER RESEARCH INSTITUTE, SARGODHA

EFFECT OF PALATABILITY ON VOLUNTARY FEED INTAKE OF PROMISING LINES/VARIETIES OF SORGHUM

Chaffed & weighed quantity of each Sorghum line/variety was offered to twelve buffaloes according to NARC schedule in nutrition stalls following Cafeteria method. Experimental animals were provided 20% additional fodder than their actual requirements. Daily consumption was recorded to evaluate palatability and voluntary feed intake. The outcomes of experiment is explained below.

Parameters	T1 Sukkar	T2 No.6001	T3 FRI-07	T4 Sorghum-2011
Quantity fed (kg)	72	72	72	72
Voluntary feed intake (kg)	53.33 B	57.50A	52.33B	50.16B
	LSD 0 .05			4.0543
Palatability (%)	71.07 B	79.86 A	72.68 B	69.67B
	LSD 0.05			5.6277
Brix(%)	11.8 B	11.1 C	10.70 C	13.10 A
	LSD 0.05			0.4430
Protein (%)	6.21B	6.92A	6.08C	6.12C
	LSD 0.05			0.0893

EFFECT OF PALATABILITY ON VOLUNTARY FEED INTAKE OF PROMISING LINES/VARIETIES OF PEARL MILLET

Each pearl millet line/variety was chaffed and offered to three buffaloes after weighing. Cafeteria method was followed according to NARC schedule. 20% additional fodder was given to these animals than their actual requirements. Consumption of these fodders was noted to determine the palatability and voluntary feed intake. The result of experiment is given below.

Parameter	Composite- IV	Q-Bajra	G-Bajra	Sargodha Bajra- 2011
Qty. fed (kg)	75.00	75.00	75.00	75.00
Voluntary feed intake (kg)	49.00A	45.00B	45.66AB	44.50B
	LSD 0.05			3.3753
Palatability (%)	65.33A	60.00B	60.89AB	59.33B
	LSD 0.05			4.4952
DM (%)	18.2 B	16.40C	19.00 A	15.60 D
	LSD 0.05			0.2514
Protein (%)	9.45 A	9.10 B	9.10 B	9.10 B
	LSD 0.05			0.1798
Crude Fiber %	20.60B	20.00C	20.70B	23.00A
	LSD 0.05			0.3782

Crude Fat %	3.89A	3.84A	3.84A	3.88A
	LSD 0.05			0.1111
Ash %	10.20C	9.87 D	10.80 A	10.50B
	LSD 0.05			0.25
NFE %	55.70B	57.20A	55.60C	53.50D
LSD 0.05				0.0999

EFFECT OF FEEDING SILAGE ON MILK QUANTITY AND QUALITY IN MILCH ANIMALS

Silage was prepared from maize and sorghum according to standard method and fed to buffaloes to see the effect of silage and green fodder plus wheat straw on milk production and quality. Green fodder plus wheat straw treatment were used as standard. Dry matter was estimated for daily requirement of animals. Nine buffaloes of almost similar stage and lactation number were selected and fed silage & green fodder plus wheat straw. Treatments were repeated thrice. Daily feed intake and milk yield was recorded. Data recorded was analyzed statistically. The effect of silage is explained below in table.

Diet	**Fed (Kg)**	**Intake (Kg)**	**Milk production (Liters) Before Trial**	**Milk production (Liters) Before Trial**
Silage	25.00	21.613B	10.170 A	10.413 A
Green fodder + Wheat straw	55.00	49.66 A	8.500 B	8.367 B
LSD 0.05		1.8666	0.5133	1.4134

Diet	**Fodder and Silage Quality Characteristics**					
	DM (%)	**Fat (%)**	**Crude Fiber (%)**	**Ash (%)**	**Protein (%)**	**NFE(%)**
Silage	31.50±0.20	3.50±0.05	24.27±0.31	7.62±0.10	12.40±0.2	52.22±0.04
Green fodder	24.40±0.2	2.60±0.01	24.00±0.33	9.67±0.02	13.70±0.2	50.01±0.08

Diet	Milk Quality Characteristics						
	Fat (%)	SNF (%)	T. Solids (%)	Protein (%)	Lactose (%)	Acidity (%)	pH
Silage	7.06A	8.67A	15.70A	3.83A	3.6667A	0.12A	6.88A
Green fodder + Wheat straw	7.1967 A	7.97A	15.17A	3.73A	3.5533A	0.11A	6.87 A
LSD 0.05	0.7865	1.4272	0.6823	1.3267	1.0760	0.0287	0.0287

INCORPORATION OF DRY LEAF POWDER OF MORINGA (Moringa oleifera) ON MILK PRODUCTION AND MILK COMPOSITION IN DAIRY BUFFALOES

The harvested leaves of Moringa were air dried in shade under a shed until they were crispy to touch, while retaining their greenish coloration. The dried leaves were then milled to produce Moringa oleifera leaf powder for incorporation. Twelve buffaloes of almost similar stage and lactation number were selected and fed according to treatment plan. Treatments were repeated thrice. Daily milk yield and milk composition analysis were carried out. Data recorded was analyzed statistically. The experiment results are explained below in tabulated form.

Diet	Moringa leaf Powder and Wanda Quality Characteristics					
	DM (%)	Fat (%)	Crude Fiber (%)	Ash (%)	Protein (%)	NFE (%)
Moringa Leaf Powder	90.03±0.40	6.17±0.15	8.00±0.50	11.67±0.15	21.83±0.21	51.60±0.87
Wanda	89.97±0.55	5.20±0.20	12.57±0.25	11.96±0.20	16.00±0.31	54.26±0.48

Diet	Milk production (Liters) Before Trial	Milk production (Liters) Before Trial
T1. Wanda+ 0gMoringa Leaf Powder	7.80A	7.88A
T2. Wanda + 75gMoringa Leaf Powder	7.56AB	7.56AB
T3. Wanda+ 150g Moringa Leaf Powder	7.45B	7.46B
LSD 0.05	0.26	0.41

Diet	Milk Quality Characteristics (Before Trial)							
	Fat (%)	**SNF (%)**	**Total Solids (%)**	**Protein (%)**	**Lactose (%)**	**Acidity (%)**	**pH**	**Salts**
T1. Wanda + 0g Moringa Leaf Powder	7.25A	8.67A	15.23A	3.52B	4.12A	0.10A	6.89A	0.53A
T2. Wanda + 75g Moringa Leaf Powder	6.73 B	7.98AB	15.24A	3.75A	3.36C	0.11A	6.89A	0.61A
T3. WANDA + 150 Moringa Leaf Powder	6.55C	7.90B	14.64A	3.87A	3.73B	0.12A	6.89A	0.61A
LSD 0.05	0.16	0.76	0.90	0.17	0.25	0.04	0.05	0.18

FODDER RESEARCH SUB-STATION, AARI, FAISALABAD.

KHARIF FODDERS TRIALS

i) **COLLECTION AND MAINTENANCE OF SORGHUM GERMPLASM**

Germplasm consisting of wide array of genetic material is maintained at the station. About 105 pure /local as well as exotic lines were maintained by bagging each line. Germplasm bank is evaluated each year for redundant material, various genetic characters and other useful attributes i-e fodder yield, sweetness, juiciness, No. of leaves, leaf length, leaf breath and disease resistant. Screening of material for biotic and abiotic stresses was also done. Collection of various desirable lines were also made from different resources/ farmer field. The seed was harvested and single head of each promising line was kept reserved in bags for further study in the next year.

ii) **HYBRIDIZATIONS AND FILIAL GENERATIONS OF SORGHUM (F1-F7)**

To cope with the increasing demands of fodder with high tonnage and better quality for livestock industry, this sub-station has initiated a project to create diversity among of elite sorghum breeding lines through hybridization and obtained flowers synchronization in the late and early maturing lines. By using polythene bag techniques and manual emasculation about 10 crosses were attempted among elite recombinants. Seed of each cross were threshed separately.

FILIAL GENERATION	CROSSES/PROGENIES	
	Studied	Selected
F1	10	09
F2	12	10
F3	18	15
F4	20	14
F5	22	12
F6	20	08

iii) **PRELIMINARY GREEN FODDER YIELD TRIAL OF SORGHUM.**

The seed was received along with sowing methodology from Director, Fodder Research Institute Sargodha. Fodder Research Sub-Station AARI, Faisalabad contributed the two elite lines. The trial was harvested for its green fodder yield .Green fodder yield of each plot was harvested weighed in kg/plot and tabulated in Mt/hac and is given below.

Table-1: Preliminary Green Fodder Yield Trial

Sr.No	Coded Varieties	GFY (t/ha)
1.	SD-167	73.68
2.	YSS-15	65.11
3.	JABLE	64.72
4.	F-01-2018	63.94
5.	FRI-02	63.55
6.	F-02-2018	62.38
7.	YSS-89	61.99
8.	NO.39501	61.99
9.	**JS-2002(check)**	**61.99**
10.	**Sorghum-2011(check)**	**60.82**
11.	NO6197	58.48
12.	I-6	57.70
13.	65174-2	57.31
14.	F-03-2018	53.02
	LSD @ 5%	7.11

It is obviously clear from the above table the lines SD-167, YSS-15and JABLE produced maximum fodder tonnage by yielding 73.68, 65.11, 64.72Mt/ ha respectively as compared to the standard varieties JS-2002 and sorghum 2011 producing **61.99**, **60.82** Mt/ hac, respectively.

iv) ADVANCE GREEN FODDER YIELD TRIAL OF SORGHUM.

The seed received along with sowing methodology from Director, Fodder Research Institute Sargodha. Fodder Research Sub-Station AARI, Faisalabad contributed the following elite lines.

The trial was laid out in R.C.B.D design with three replication holding plat size 1.8 x $6m^{2.}$ Data of various morphological traits was recorded i.e. plant height, No, of leaves, No. of tiller/plant, leaf area and various other observations regarding sweetness, juiciness, color etc were also noted. The trial was harvested for its green fodder yield .Green fodder yield of each plot was harvested weighed in kg/plot and tabulated in mt/hac and is given below.

Sr.#	Coded Varieties	GFY (t/ha)
1.	SGD-02-17	77.78
2.	SGD-01-17	72.59
3.	F-01-2017	68.52
4.	NO.5017	63.70
5.	**Sorghum-2011 (check)**	**61.11**
6.	**JS-2002(check)**	**59.63**
7.	F-2-2017	57.41
8.	NO.1863	39.26
	LSD @ 5%	6.7

From the above data, it is clear that lines SGD-02-17, SGD-01-17and F-01-2017produced better fodder tonnage i.e 77.78, 72.59, 68.52Mt/ hac respectively than the commercial check varieties **Sorghum-2011 (check)**and **JS-2002(check)** yielding **61.11**, **59.63** Mt/hac respectively.

v) ADAPTATION GREEN FODDER YIELD TRIAL OF SORGHUM

The trial was received from Director, Fodder Research institute Sargodha and was planted at fodder Research Sub-station AARI Faisalabad. The trial consisted of 8 varieties including two commercial check varieties. The trial was laid out in R.C.B.D design with three replications plot holding plot size 1.8x 6m .The data of varieties. The data of various Morphological and agronomic traits was recoded at 50% heading. The trial was harvested for its green fodder yield potential. Each plot was harvested and weight in kg/plot and tabulated in M.t/ hac is under below.

Sr. No	Coded Varieties	Green Fodder Yield (t/ha)
1.	F-02-2016	72.59
2.	S-145	72.22
3.	PVK-801	64.81
4.	FRI-07	64.07
5.	**SORGHUM-2011 (check)**	62.59
6.	**JS-2002 (check)**	61.85
7.	JS-01	61.11
8.	F-01-2016	54.07
	LSD @ 5 %	7.04

VI) NATIONAL UNIFORM GREEN FODDER YIELD TRIAL OF SORGHUM

The trial was received from Coordinator Fodder NARC Islamabad and was planted on at Fodder Research sub-station AARI, Faisalabad. The trial was laid out in R.C.B.D design with three replication holding plot size 1.8 x 6m. The trial was harvested on 24-10-2011 at the completion of 50% heading. The data of various morphological traits was recorded. Each plot was harvested for its green fodder yield and weighed in kg/plot and green fodder yield is Mt/hac is given below

i) ZONAL GREEN FODDER YIELD TRIAL ON PEARL MILLET

The seed, along with the sowing plan was received from Director, Fodder Research Institute Sargodha along with sowing plan and methodology.

The trial consisting of 08 coded millet varieties. The trial was harvested at 50% flowering and data on morphological traits was noted. Green fodder yield Mt/hac is given below.

Sr.No	Coded Varieties	GFY (t/ha)
1.	G WHITE	64.51
2.	NO7703	62.65
3.	FB-797	62.35
4.	C2K923	61.73
5.	FB-791	59.57
6.	FB-809	57.41
7.	Sgd.Bajra.2011	54.63
8.	C2K923	53.09
	LSD @5%	8.1

C) RABI FODDERS TRIALS

BERSEEM

i) MAINTENANCE OF GENEPOOL OF BERSEEM

About 100 pure lines of berseem genepool were maintain at Fodder Research Sub-Station AARI, Faisalabad. As berseem is highly crosses pollinated crop. So to prevent this, among the two berseem lines of one line, one line of oats for isolation barrier was planted. Critical observation about the behavior and growth of all entries were noted. The data of various desirable traits i.e. Plant Height, No of leaves, No. of tiller/plant; their cutting habits etc were recorded screening of the material is also done. Selection of various plants having desirable morphological traits was also done. Seed of each line was preserved in bag for next year study.

ii) PRELIMINARY GREEN FODDER YIELD TRIAL OF BERSEEM

The coded seed was received from Director, Fodder Research Institute Sargodha along with sowing plan and methodology.

The two advance lines were incorporated from Fodder Research Sub-Station, AARI, Faisalabad. The layout of the trial were R.C.B.D design with plot size 3m x 5m having 3 replications. The agronomic and morphological data of various traits i.e. plant height, No, of leaves, No. of tiller/plant, leaf area and green fodder yield is noted. Each plot was harvested and weighed in kg/plot. The fodder yield data of all the four cuts was tabulated in mt/hac and is given below.

Sr#	Entries	Green Fodder yield (t/ha 5 cuts)
1	FB-1-18	138.67
2	FB-2-18	135.78
3	SB-1-18	125.78
4	SB-4-18	121.56
5	SB-6-18	121.11
6	SB-5-18	120.89
7	Agaiti (Check)	118.22
8	SB-2-18	116.67
9	Anmol Check)	113.78
10	SB-3-18	110.89
LSD 0.05		8.4

The data presented in the above table revealed that the line FB-1-18produced maximum green fodder yield (138.67Mt/ hac) followed by FB-2-18, SB-1-18 yielding 135.78, 125.78 Mt/ hac respectively as compared to the check varieties Agaiti berseem and Anmol berseem producing 118.22and 113.78Mt/ ha respectively.

ii) ADVANCED GREEN FODDER YIELD TRIAL OF BERSEEM

The trial was received from Director, Fodder Research Institute Sargodha. The trial consisting of the 6 lines including two check varieties and was planted at Fodder Research Sub-Station AARI Faisalabad. The trail was laid out in R.C.B.D design with three replication holding plot size 3m x 5m. The agronomic and morphological data of various traits i.e. plant height, No, of leaves, No. of tiller/plant, leaf area and green fodder yield is noted.

Sr#	Decoded Entries	GFY (t/ha) 5cuts
1	FB-2-17	127.56
2	SB-4-17	124.89
3	SB-3-17	122.44
4	FB-1-17	122.00
5	Agaiti (Check)	120.22
6	SB-1-17	119.33
7	SB-2-17	115.56
8	Anmol (Check)	109.78
LSD 0.05		5.12

iv) **ADAPTATION GREEN FODDER YIELD TRIAL OF BERSEEM**

The trial was received from Director, Fodder Research Institute Sargodha. The trial consisting of the 7 lines including two checks and was planted at Fodder Research Sub-Station AARI Faisalabad. The trail was laid out in R.C.B.D design with three replication holding plot size 3m x 5m. The data of various parameters regarding traits i.e. plant height, No, of leaves, No. of tiller/plant, leaf area and green fodder yield is noted. The green fodder yield of all the four cuts was tabulated in Mt/hac and is given below.

Sr#	Entries	GFY 5 cuts (t/ha)
1	FB-2-16	118.67
2	SB-2-16	114.67
3	SB-3-16	106.44
4	Agaiti (Check)	102.44
5	FB-1-16	96.89
6	SB-5-16	88.44
7	Anmol (Check)	84.22
LSD 0.05		2.3

The above table obviously showed that the variety FB-2-16and SB-2-16 produced highest pooled green fodder yield 5 cuts yielding 118.67Mt/ hac and 114.67Mt/hac respectively as compared to the check varieties Agaiti berseem and Anmol berseem yielding 102.44, 84.22Mt/ hac respectively.

OATS

i) **PRELIMINARY GREEN FODDER YIELD TRIAL OF OATS**

The trial was received from Director, Fodder Research Institute Sargodha. The trial was planted at Fodder Research Sub Station AARI, Faisalabad and was harvested for its green fodder yield. The layout of the trial was R.C.B.D with plot size 1.8m×6m having 3 replications. The data of various morphological traits were recorded. Green fodder yield/plot is noted and calculated in Mt/hac as is given below.

Sr#	Entries	GFY (t/ha)
1.	No.663	73.84
2.	FO-02-18	71.99
3.	No.615	69.44
4.	F-146	68.29
5.	FRI-683	68.29
6.	FRI-152	68.06
7.	No.2008	67.59
8.	Sgd Oats-2000(Check)	65.97
9.	FRI. No.2008	65.28
10.	No.9701	63.66
11.	FO-01-18	61.57
12.	Sgd Oats-2011(Check)	60.19
LSD 0.05		**4.6**

iii) ADVANCE GREEN FODDER YIELD TRIAL OF OATS

The trial was received from Director, Fodder Research Institute Sargodha. The trial was planted at Fodder Research Sub Station AARI, Faisalabad and harvested. The layout of the trial was R.C.B.D with plot size 1.8m×6m having 3 replications. The data of various morphological traits were recorded. Green fodder yield/plot is noted and calculated in Mt/hac as is given below.

Sr#	Entries	GFY t/ha
1.	FRI-152	75.00
2.	F-401	73.38
3.	No.85/125	72.69
4.	No.668	72.45
5.	FRI-153	71.99
6.	No.301	70.60
7.	SGD Oats-2000((Check)	70.60
8.	FRI-034	70.37
9.	F-406	69.44
10.	FRI-6001/15	67.59
11.	No.669	67.36
12.	SGD Oats-2011(Check)	66.44
LSD 0.05		**5.2**

iii) ADAPTATION GREEN FODDER YIELD TRIAL OF OATS

The trial was received from Director, Fodder Research Institute Sargodha. The trial was consisting of 12 lines including one check variety. The trial was planted at Fodder Research Sub Station AARI, Faisalabad and was harvested. The layout of the trial was R.C.B.D with plot size 1.8m×6m having 3 replications. The data of various parameters were recorded. Green fodder yield/plot is noted and is calculated in Mt/hac as is given below.

Sr#	Decoded Entries	GFY(t/ha)
1.	No.632	98.46
2.	F-415	96.91
3.	No. 677	96.60
4.	SGD-1	96.30
5.	SGD Oats-2011(Check)	94.75
6.	ERK	94.14
7.	FRI-01	91.36
8.	FRI-03	90.43
9.	CK-1	88.89
10.	Sgd Oats-2000(Check)	87.04
11.	FRI-02	84.57
12.	SGD-46	83.33
LSD 0.05		6.23

EXPERIMENTAL SEED PRODUCTION UNIT, FAROOQABAD.

(A) KHARIF EXPERIMENTS.

i) ZONAL GREEN FODDER YIELD TRIAL OF SORGHUM

The experiment consisted of eight promising single cut Sorghum varieties supplied by the Directorate of Fodder Research Institute, Sargodha. The varieties were planted in three replications using randomized complete block design keeping size of plot at 1.8x5m.Data on green fodder yield for single cutting was recorded at 50 percent heading. The data of green fodder yield is given below.

S. No.	Varieties/Lines	Green Fodder Yield (t/ha)
1.	S-145	46.66
2.	FRI-07	57.77
3.	PVK-801	46.28
4.	Sorghum-2011 (check)	48.51
5.	F-02-2016	42.22
6.	JS-2002 (check)	48.14
7.	F-01-2016	38.5
8.	JS-1	41.47

ii) **ZONAL GREEN FODDER YIELD TRIAL OF PEARL MILLET**

Eight promising varieties of Pearl Millet (Bajra) supplied by the Directorate of Fodder Research Institute , Sargodha were sown in three replications using randomized complete block design with a plot size of 1.8x6m to ascertain the green fodder yield of single cutting at 50 percent heading stage .all agronoimic practices were performed. The data was recorded. The data of green fodder yield is given below.

S. No.	Varieties/Lines	Green Fodder Yield (t/ha)
1.	G.White	93.50
2.	FB.809	96.29
3.	Q Bajra	82.40
4.	FB.791	85.00
5.	CZ K 923	71.29
6.	FB.797	73.00
7.	Sgd.Bajra 2011 (Check)	76.00
8.	No: 7703	69.40

ZONAL GREEN FODDER YIELD TRIAL OF PEARL MAIZE

Eight promising varieties of Maize supplied by the Directorate of Fodder Research Institute , Sargodha were sown in three replications using randomized complete block design with a plot size of 1.8x6m to ascertain the green fodder yield of single cutting at 50 percent heading stage .all agronomic practices were performed. The data was recorded. The data of green fodder yield is given below.

S. No.	Entry	Yield (t/ha)
1	MS-01-2016	28.88
2	MS-04-2016	28.51
3	MS-07-2016	30.73
4	FSD.2020	30.50
5	MS-03-2015	33.70
6	MS-05-2016	27.77
7	Sgd.2002 (Check)	27.40
8	FSD.2025	27.30

PRE-BASIC SEED PRODUCTION OF KHARIF FODDERS UNDER PROJECT ENTITLED "IMPROVEMENT IN BREEDING AND SEED PRODUCTION SYSTEM OF FODDER CROPS

The packed seed plan was supplied by Director, Fodder Research Institute Sargodha and the trial was laid out accordingly. The station produced pre-basic seed of approved cultivar of maize Sgd-2002 and sorghum varieties according to provided plan. The detail of seed produced is given below.

Sr. No.	Variety/crop	Seed produced pre-basic (Kg)
1.	Sgd-2002	6300
2.	Sorghum-2002	1550
3.	Sorghum Hegari	410
4.	Sorghum-2011	300

(B) **RABI EXPERIMENTS.**

ADAPTABILITY YIELD TRIAL OF BERSEEM

The experiment consisted of Seven promising varieties of Berseem which were supplied from the Directorate of Fodder Research Institute , Sargodha. These varieties were sown in three replications using randomized complete block design keeping plot size of 5 meter x 3 meter . Data on green fodder yield from each of the five cuttings were recorded at appropriate time intervals.

S. No.	**lines/ varieties**	**Green Fodder Yield (t/ha)**
1.	SB-3-16	123.1
2.	SB-2-16	118.4
3.	FB-1-16	117.8
4.	FB-2-16	114.7
5.	Anmol (check)	113.6
6.	SB-5-16	113.1
7.	Agaiti (check)	110.4

EVALUATION OF DIFERENT BERSEEM VARITIES AVAILABLE IN LOCAL MARKET AGAINST APPROVED VARITIES FOR GREEN FODDER

The varieties were sown using Randomized Complete Block Design (RCBD) with 3 replications. The crop was raised adopting standard agronomic practices. Data on green fodder yield of each cutting was recorded. Six cuts of the crop were received and data was analyzed statistically.

S. No.	Lines/varieties	Green Fodder Yield (t/ha)
1.	Agatti	128.1
2.	SB-11	124.8
3.	Pachatti Berseem	121.3
4.	Haroo	115.0
5.	Supper late	114.1
6.	Desi	112.4
7.	Missrri	112.3

PRE-BASIC SEED PRODUCTION OF APPROVED VARIETIES OF BERSEEM/LINES

Two acres of each variety were sown to increase the seed. The crops were raised adopting standard agronomic practices. The green fodder was obtained till 31 March after that crop was left over for seed setting. The detail of obtained seed is given below.

S.#	Variety	Seed produced
1.	Pachaiti Berseem	540 kg
2.	Supper late	440 kg
3.	SB-11	420 kg
4.	Agaiti Berseem	380 kg

ADAPTABILITY YIELD TRIAL OF OATS

The lines/varieties were sown using Randomized Complete Block Design (RCBD) with 3 replications. The crop was raised adopting standard agronomic practices. Data will be recorded and analysed statistically. The results are given below.

S. No.	Lines/varieties	Green Fodder Yield (t/ha)
1.	FRI -03	97.24
2.	SGD-1	96.31
3.	No-632	95.13
4.	S-2000(check)	94.44
5.	F- 415	94.20
6.	CK-1	93.81
7.	ERK	93.75
8.	Sgd Oat 2011(check)	93.28
9.	FRI-02	91.66
10.	FRI-01	89.81
11.	SGD-46	85.87
12.	NO. 667	71.22

INCOME TARGETS AND ACHIEVEMENT

Name of Station	Income Target (Rs)	Achieved (Rs)
Fodder Research Institute, Sargodha	6544000	8043815
Agronomist (Forage Production), AARI, Faisalabad	2444000	2523498
Agricultural Research Station, Bahawalpur	2612000	3629250
Fodder Research Station, AARI, Faisalabad	1057500	1237995
Experimental Seed Production Unit, Farooqabad	2662000	1629678
Hill Grasses Research Sub-Station, Churrepani, Murree	60000	0
Total	**15379500**	**15434558**