

**ANNUAL REPORT**  
**(2020-21)**



**FODDER RESEARCH INSTITUTE**  
**SARGODHA**

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## **ANNUAL REPORT 2020-21**

### **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 contribute 41.98 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. Sargodha bajra 2020, Naimat and Barkat of Alfalfa, Pak Sorghum and Ausaf of sorghum have been approved by the Provincial Seed Council for general cultivation. Moreover, 1 line of oats have been recommended by expert sub-committee.

## **FODDER RESEARCH INSTITUTE, SARGODHA**

### **SORGHUM BREEDING TRIALS**

#### **Maintenance of gemplasm of sorghum.**

The breeding material comprising 610 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 10-15 heads of each entry was kept for further studies in next year

#### **Hybridization and filial generation.**

With the help of polythene bag technique and manual emasculation about 45 crosses were attempted among the elite lines during the year 2020 but 40 crosses remained successful. Seed of each F0 cross was threshed separately and preserve to observed the hybrid vigor in the next year F1 generation. The detail of filial generation studied during the year is given below:

<b>Filial Generations</b>	<b>Entries Studied</b>	<b>Selected Progenies/Plants</b>	<b>Uniform Lines Selected</b>
<b>F1</b>	40 crosses	32	-
<b>F2</b>	15 crosses	35 Plants of 15 crosses	-
<b>F3</b>	30 Plants Progenies of 20 crosses	37 Plants of 18 crosses	-
<b>F4</b>	32 Plants Progenies of 32 crosses	35 Plants of 20 crosses	-
<b>F5</b>	35 Plants Progenies of 20 crosses	25 Plants of 15 crosses	
<b>F6</b>	25 Plants Progenies of 5 crosses	-	<b>3</b>

#### **Preliminary fodder yield trial of Sorghum**

The experiment consisting of 14 entries along with one check variety was sown in order to pin point the highest green fodder yield of sorghum lines. 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**

<b>S. No.</b>	<b>Lines/Varieties</b>	<b>GFY (t/ha)</b>
1	No.66001	72.67
2	YSS-16	67.67
3	B line	58.33
4	FRI-06	58.33
5	Balo	57.67
6	FRI-02	57.67

7	Sorghum-2011 (check)	57.67
8	NO.80010	57.00
9	SSA-2019	56.67
10	No.7	53.67
11	F-01-2020	53.33
12	NO.880022	51.33
13	PARC- SS-1	47.67
14	F-02-2020	46.33
	LSD 0.05	06.23
	C.V %	18.00

On the perusal of Table-1, it was noted that line No.66001 produced maximum green fodder yield (72.67 t/ha.) followed by the line YSS-16 (67.67 t/ha.) whereas the check variety produced 57.67 t/ha green fodder yield.

#### **Advanced 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 with 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	GFY (t/ha)
1	No. 9802	73.26
2	No.74702	70.67
3	No-6197 F-903	66.23
4	F-01-2018	62.16
5	ABRS-SG-1	60.68
6	F-01-2019	58.46
7	Sorghum-2011 (check)	58.09
8	ABR-MS	48.10
	LSD 0.05	06.54
	C.V %	15.00

Data showed that the promising line No. 9802 out yielded the check variety by giving highest green fodder yield (73.26 t/ha.) followed by line No.74702 (70.67 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 with 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	AVG (t/ha)
1.	F-01-2018	53.33	82.96	55.18	79.89	67.84
2.	Jable	60.67	75.56	60.73	68.69	66.41
3.	F-02-2018	48.00	80.74	51.85	83.25	65.96
4.	SD-167	57.00	78.52	56.29	70.90	65.68
5.	No-6197	53.67	78.52	56.66	63.84	63.17
6.	YSS-89	51.00	83.70	57.30	57.86	62.47
7.	YSS-15	47.67	73.70	57.77	42.18	55.33
8.	Sorghum -2011	46.00	63.33	53.07	51.14	53.39

Data revealed that the promising line F-01-2018 out yielded the check variety by giving the highest green fodder yield (67.84 t/ha.) followed by Jable (66.41 t/ha.).

### **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.

Purpose	Number of crosses
Multicut	4
Dual Purpose (Grain/Fodder)	4
Total	08

All the crosses were attempted but only 3 were successful.

#### **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 1.8x6m in 30cm apart rows. The crop was harvested at 50 % heading. Green fodder yield data were recorded and are given below:-

**GREEN FODDER YIELD**

<b>S.No.</b>	<b>Varieties / Lines</b>	<b>Green Fodder Yield (t/ha.)</b>
5	NO.8861	52.13
11	DB-5	49.99
3	YBS-70	46.00
6	YBS-93	44.77
7	YBS-92	43.85
2	96041	43.24
9	YB-89	42.63
10	NO-8856	40.79
8	SGD-BAJRA2011	40.17
4	NO.8860	39.87
12	KING BAJRA	38.95
1	YBS-94	31.59
	LSD	4.19

Data showed that line No.52.13 gave maximum green fodder yield (40.17 t/ha.) and was followed by line DB-5 (49.99 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**

<b><u>S.no.</u></b>	<b><u>Varieties / lines</u></b>	<b><u>Green fodder yield (t/ha)</u></b>
3	Y-84	61.64
2	RAJ	58.88
1	BAJRA 2011	55.81
4	COMPOSITE-5	49.07
8	W-RAJ	49.07
6	WATNI	48.76
5	RCBK-948	44.47
7	S-2017	44.47
	LSD	4.63

Data showed that line / variety Y-84 produced maximum green fodder yield (61.64 t/ha.) and was followed by RAJ (76.05t/ha.).

### **Zonal Green Fodder Yield Trial Of Pearl Millet**

Trial consisting of 6 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	HIGH GROUP	57.35	55.10	75.70	85.40	68.39
2	EXBD-2 BULK	46.00	57.00	70.70	96.29	67.50
3	N-5	49.99	62.60	81.00	76.00	67.40
4	SGD BAJRA 2011(check)	37.41	64.10	84.70	80.70	66.73
5	DBR-3	41.40	59.20	81.30	85.00	66.73
6	COMPOSITE-5	43.24	61.30	76.00	82.40	65.74

## **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<sub>1</sub> and C<sub>2</sub> generations were collected for further study and selection process.

### **Preliminary Fodder Yield Trial Of Maize**

The trial consisting of 10 promising lines/ varieties was laid out in RCBD with 3 replications having a plot size of 1.8x5m with 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-07-2020	52.96
2	MS-02-2020	49.62
3	FM-01-2020	48.51
4	Super Green Maize (Check)	48.14



5	FM-02-2020	40.37
6	MS-08-2020	39.26
7	MS-01-2020	37.40
8	Sgd.2002 (Check)	37.03
9	MS-06-2020	32.22
10	MS-04-2020	28.89
	LSD (5%)	7.23

Data showed that the promising line ‘MS-07-2020’ gave higher green fodder yield (58.51 t/ha) followed by the line MS-02-2020 (55.92 t/ha.) as compared to check varieties ‘Super Green Maize’ and Sgd.2002 which produced 48.14 and 37.40 t/ha of green fodder yield.

#### **Advanced Fodder Yield Trial Of Maize**

Eight promising 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 with 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	MS-02-2019	50.37
2	MS-08-2019	44.44
3	MS-03-2019	43.70
4	MS-05-2019	42.22
5	Super Green Maize (Check)	41.85
6	Sgd.2002 (check)	39.63
7	MS-09-2019	33.70
8	MS-04-2019	31.85
	LSD (5%)	6.78

Data revealed that the promising line ‘MS-02-2019’ gave higher green fodder yield (50.37 t/ha) followed by the line MS-08-2019 (44.44 t/ha.) as compared to check varieties ‘Super Green Maize’ and Sgd.2002 which produced 41.85 and 39.63 t/ha of green fodder yield.

#### **Adaptability Green Fodder Yield Trial Of Maize**

Seven advance lines /varieties were tested at four 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	FM-02-2019	48.51	55.2	42.17	47.4	48.32
2	MS-04-2018	49.25	51.5	41.14	40.72	45.65
3	Super Green Maize (Check)	46.66	58.1	33.09	40.78	44.66
4	MS-06-2018	47.22	40.4	38.55	41.12	41.82
5	Sgd.2002 (Check)	41.6	51.1	37.22	34.06	41.00
6	Composite-02	35.92	48.9	36.56	40.74	40.53
7	MS-05-2018	37.03	41.1	31.55	34.08	35.94
	LSD 5%	5.78	8.2	7.15	4.80	-

Data showed that on an average the promising line FM-02-2019 gave higher green fodder yield of 48.32 t/ha as compared to check varieties 'Super Green Maize' and Sgd.2002.

### **S.S. HYBRID**

#### **Maintenance And Seed Production Of 'A, 'B'lines Of Sorghum And R Lines Of Sudan Grass**

'A' & 'B' lines of sorghum and R lines of Sudan Grass 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.

#### **National Uniform Fodder Yield Trial Of Ss Hybrid**

A trial consisting of 24 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 1: Average of Green Fodder Yields of 11 Locations of National Uniform Fodder Yield Trials (NUFYTs)**

S.No	Lines / Varieties	Green Fodder Yield (t/ha)
1	Cowpow	146.86
2	SAHARA GRASS	137.13
3	MARSHAL	132.96
4	DIAMOND-SG-121	144.55
5	ULTRA-GRASS	142.57
6	EVERGREEN-786	131.55
7	SWEET HONEY	130.7
8	PAK SUDEX(CHECK)	119.02
9	SWEET & SOFT	118.4
10	TIGER GRASS	134.86
11	FAIR BAMBOO	125.65

12	BF-786	121.41
13	NOOR SORGHUM	115.15
14	SS II MATRA ASIA	131.29
15	TAHAFUZ SG-122	127.73
16	FMC-200	144.69
17	FMC-100	131.05
18	EAGLE GRASS	135.4
19	MILKY GRASS	130.43
<b>20</b>	<b>S.S-2 FRI</b>	<b>125.16</b>
21	DACHI	136.29
22	POWER GRASS	129.28
<b>23</b>	<b>S.S 1 FRI</b>	<b>121.09</b>
24	AK-113	116.03

Both lines i.e S.S-1 and S.S-2 contributed by FRI Sargodha in NUFYT 2020 performed better than the check variety 'Pak sudex'.

## **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 12 cowpeas lines/ varieties for testing their green fodder yield potential. The experiment was laid out in RCBD with 3 replications having a plot size of 3x6m. The green fodder yield data are given in the table.

Table-11 **Green Fodder Yield**

<b>S. No</b>	<b>Lines/varieties</b>	<b>Green fodder yield (t/ha)</b>
1	CP-95	40.13
2	CP-96	38.52
3	Elite	38.18
4	CP-219	37.41
5	CP-035	35.85
6	IT-82E-715	33.52
7	CP-101	33.41
8	Rawan-2003 (check)	33.41
9	SS-92-2	30.91
10	AYT-CP-021	26.20
11	SS-92-1	23.75
12	AYT-CP-012	20.65
	LSD	3.80

Data showed that the promising line CP-95 gave highest green fodder yield (40.13 t/ha.) followed by the line CP-96 (38.52 t/ha.) as compared to check variety Rawan-2003 (33.41 t/ha)

#### **Advance Green Fodder Yield Trial Of Cowpeas**

Nine 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 60cm apart rows. The crop was harvested at 50% heading. Green fodder yield data were recorded below.

Table-12 **Green Fodder Yield**

<b><u>S.No</u></b>	<b><u>LINES/VARIETIES</u></b>	<b><u>Green Fodder Yield (t/ha)</u></b>
1.	CP-271	40.53
2.	CP-162	40.52
3.	CP-96	38.13
4.	IT-82E-715	35.85
5.	Elite	34.80
6.	Rawan-2003 (check)	28.53
7.	CP-035	25.42
8.	CP-101	24.14
9.	CP-219	22.42
	LSD 0.05	6.03

Data revealed that the promising line CP-271 gave higher green fodder yield of 40.53 t/ha as compared to check variety Rawan-2003 (28.53 t/ha).

#### **Adaptability Green Fodder Yield Trial Of Cowpeas**

Seven advance lines /varieties were tested at three 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**

<b><u>Sr. No</u></b>	<b><u>Lines Varieties /</u></b>	<b><u>FRI, Sargodha</u></b>	<b><u>Agronomy (F.P) AARI</u></b>	<b><u>ESPU, Farooqabad</u></b>	<b><u>Average (t/ha.)</u></b>
1	IT82E-715	40.60	43.75	34.50	39.62
2	CP-162	38.40	34.07	25.12	32.53
3	Elite	33.10	30.58	31.65	31.78
4	CP-101	27.20	38.70	27.00	30.97
5	CP-271	35.20	24.50	33.00	30.90
6	Rawan-2003 (check)	31.85	30.24	27.50	29.86
7	CP-219	30.27	26.08	27.30	27.88
	LSD 0.05	4.01	-	-	

Data showed that on an average the promising line IT82E-715 gave higher green fodder yield of 39.62 t/ha as compared to check variety Rawan-2003 (29.86 t/ha)

## **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**

<b>Crops</b>	<b>Varieties</b>	<b>Selected No. of Heads.</b>	<b>Selected No. of Head -Row.</b>	<b>Selected row to block.</b>	<b>BNS (kg.)</b>	<b>Pre-Basic (kg.)</b>
Sorghum	Hegari	50	24/50	17/28	70	2480
	JS-263	30	18/30	09/16	12	142
	JS-2002	50	26/50	18/24	30	864
	Sorghum-2011	40	32/50	20/32	15	704
Pearl Millet	MB-87	30	12/30	11/18	06	-
	Sgd. Bajra	30	14/30	10/21	10	-
Maize	Sgd. 2002	50	23/50	15/26	30	255
	Super Green Maize	50	32/50	19/30	60	440

## **OATS BREEDING TRIALS**

### **Collection, Evaluation And Maintenance Of Germplasm Of Oats**

New collection was done and added to existing germplasm . A total of 330 germplasm lines were maintained and data collected as compared to previous 130 entries. 330 entries/lines were planted in 30 cm apart in paired rows. Off-type plants were rogued out to maintain their purity. The seed of these lines was preserved for further studies.

### **Hybridization Programme Of Oats**

Oats hybridization is a continuous practice at this institute and basic tool for improving and widening the genetic basis of oats crop. In this regard total 30 crosses were attempted keeping in view crop improvement parameters especially green fodder yield resistance against rust disease and stay green oats varieties.

### **Study Of Filial Generations Of Oats**

Different generations of oats, F<sub>2</sub> to F<sub>6</sub> were studied and desirable recombinants were selected for next filial generation.

<b>Filial Generations</b>	<b>Entries Studied</b>	<b>Selected Progenies/Plants</b>	<b>Uniform Lines Selected</b>
F1	9 crosses	3 crosses	-
F2	3 populations of 3 crosses	30 plants of 5 crosses	-
F3	30 plant progenies of five crosses	20 plants of 4 crosses	-
F4	20 plant progenies of four crosses	12 plants of 3 crosses	-
F5	2 plant progenies of three crosses	8 plants of 2 crosses	-
F6	plants progenies of two crosses	-	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**

<b>S.No.</b>	<b>Line / Variety</b>	<b>G.F.Y. (t/ha)</b>
1	No.22377	79.58
2	Border	79.35
3	Super Green Oat	77.51
4	Victory	76.59
5	FRI-024	76.13
6	No.555	75.44
11	FRI-09	72.68
12	No.618	72.22
7	No.562	68.08
8	FO-01-02	67.62
10	FO-02-02	66.65
11	No.612	62.79
12	No.22377	79.58
LSD5% (11.5)		

As it is clear through the data given above the oats line no.22377 / gave maximum green fodder yield (79.58 t/ha.) and was followed by lines Border (79.53 t/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.689	81.65
2.	FRI-152	80.73
3.	Hay Sgd.	79.35
4.	No.613	77.74
5.	No.618	77.05
6.	No.5527	74.75
7.	No.22374	70.35
8.	FO-02-19	69.69
9.	FO-01-19	66.93
10.	No.558	63.61

Data revealed that the line NO.689 out yielded all the entries included in the trial by giving 81.65 t/ha green fodder yield and was followed by FRI-152 (80.73 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
No.970	80.34	95.68	96.31	67.1
No.663	83.21	89.84	97.24	71.4
F-146	82.8	95.36	95.13	68.8
No.615	89.24	90.76	89.81	65.4
FRI-153	84.94	84.02	91.66	82.1
F-02-18	78.50	96.28	94.20	80.4
Ever Green Oats	75.74	94.14	93.28	82.1
No.669	80.96	93.52	93.75	77.7
NO.301	81.57	94.44	94.44	64.8
FO-01-18	79.12	81.56	92.81	69.8
No.970	80.34	82.80	85.87	67.1
No.663	83.21	95.68	71.22	71.4

Data revealed that the line NO.615 out yielded all the entries included in the trial by giving 51.6589.24 t/ha green fodder yield and was followed by FRI-153 (84.94 t/ha.).

## **BERSEEM**

### **Maintenance of germplasm.**

Seventy 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 12 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
1.	SB-4-20	125.56
2.	FB-2-20	121.56
3.	SB-2-20	121.11
4.	SB-5-20	120.89
5.	SB-6-20	120.44
6.	Anmol (Check)	119.56
7.	FB-1-20	117.33
8.	SB-3-20	116.44
9.	SB-1-20	116.00
10.	Punjab Bereem(Check)	114.67
11.	SB-8-20	107.56
12.	SB-7-20	103.78

Data revealed that line / variety SB-4-20gave the maximum green fodder yield (125.56t/ha.) and was followed by the Line / variety FB-2-20(121.56 t/ha.) and check variety Punjab Berseem (114.67t/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
1.	SB-5-19	121.78



2.	SB-6-19	120.00
3.	SB-4-19	119.78
4.	FB-2-19	118.89
5.	FB-1-19	116.00
6.	SB-3-19	115.33
7.	Punjab Berseem (Check)	113.56
8.	Anmol (Check)	112.44

Data revealed that line / variety SB-5-19 gave the maximum green fodder yield (121.78t/ha.) and was followed by the line / variety SB-6-19(120.t/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(t/ha)			
		FRI, Sargodha	ARS, B/Pur	ESPU, Farooqabad	Avg.
1.	SB-6-18	122.67	100.89	133.33	118.96
2.	SB-5-18	124.8889	102.00	126.00	117.63
3.	SB-4-18	118.8889	93.11	135.56	115.85
4.	SB-1-18	122.6667	97.78	126.22	115.56
5.	FB-1-18	120.8889	104.00	120.00	114.96
6.	FB-2-18	120.67	87.33	134.67	114.22
7.	Punjab Berseem (Check)	119.56	95.33	124.22	113.04
8.	ANMOL (check)	117.78	91.78	128.44	112.67

Data showed that line SB-6-18gave maximum green fodder yield (118.96t/ha.) followed by line / variety SB-5-18 (117.63t/ha.)

#### **National uniform fodder yield trial of berseem**

A trial consisting of 10 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:-

#### **LUCERNE**

##### **Collection and maintenance of germplasm.**

220 lucerne genotypes were sown in 60 cm apart rows of 10m length. The genotypes were properly maintained. The crop is near to maturityand seeds willbe collected for further studies.

### **Preliminary Green Fodder Yield Trial**

Field trial consisting of 11 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 1.8x4 m<sup>2</sup> in 30cm apart rows. The yield data was recorded and is given below;

Table-1; **Green Fodder Yield**

S.No	Lines / Varieties	Green Fodder Yield (t/ha)
1.	Bover	93.52
2.	FA-1-20	91.67
3.	viger 1	90.74
4.	viger2	90.74
5.	1103	87.96
6.	GR-800	87.96
7.	1107	87.96
8.	565-82	87.96
9.	Lucerne-2002(ck)	86.57
10.	China	81.48
11.	KQS-02	<b>80.09</b>

Data showed that line Bover gave maximum green fodder yield (93.52 t/ha.) followed by FA-1-20 (91.67 t/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-2; **Green Fodder Yield**

Sr.No	Lines / Varieties	Green Fodder Yield (t/ha)
1.	No. 53	78.70
2.	Sunder	77.31
3.	CUF-101	75.46
4.	Silverado	75.00
5.	SGS-82	75.00
6.	Icon-13	73.61
7.	5-In-59	73.61
8.	Oman	73.61
9.	Sgd. Lucerne	72.22
10.	sard-10	71.76

11.	No.7613	70.83
12.	FRI001	70.83

Data showed that line No.53 gave maximum green fodder yield (78.7 t/ha.) followed by Sunder (77.31 t/ha.).

### **Adaptability Green Fodder Yield Trial**

Field trial consisting of 8 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-3; **Green Fodder Yield**

Sr.No	Lines / Varieties	Green Fodder Yield (t/ha)
<u>1</u>	ICON-13	111.11
<u>2</u>	FA-1-19	106.94
<u>3</u>	CUF-101	106.94
<u>4</u>	5-IN-59	105.09
<u>5</u>	No.7613	104.63
<u>6</u>	SARD-10	104.17
<u>7</u>	Sgd. Lucerne (check)	99.54
<u>8</u>	Silverado	94.91

Data showed that line ICON-13 gave maximum green fodder yield (111.6t/ha.) followed by FA-1-19 (106.94t/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	32/50	41/64	132	2250
	Pachaiti	50	24/50	34/60	113	1020
	Anmol	50	36/50	39/72	102	1510
	Punjab Berseem	50	-	-	-	1530
Oats	S-2000	50	20/50	30/68	189	1280
	Sgd. Oats -2011	50	25/50	34/56	237	2400
	Super Green Oats	50	-	-	-	720
	Ever Green Oats	50	-	-	-	360
Lucerne	Sgd. Lucerne	50	21/50	19/32	14	200

## **AGRONOMY TRIALS**

### **Effect Of Legumes Intercropping On Sorghum Fodder Production**

This trial was conducted to find out the effect of legumes intercropping on sorghum fodder production. Four treatments were used Sorghum+ Jantar ,Sorghum + Guar. Sorghum+ Cowpeas and Sorghum alone . The system of lay out was RCBD with 4 replications having plot size of 3.6x6m.It was sown in the month of July. Data regarding G.F.Y was recorded and is given below.

<b>Treatments</b>	<b>Green Fodder Yield (t/ha)</b>
<b>T1 Sorghum+Jantar</b>	72.68
<b>T2 Sorghum+Guar</b>	70.76
<b>T3Sorghum+ Cowpeas</b>	68.30
<b>T4 Sorghum alone</b>	65.50
<b>LSD 5%</b>	1.80

Sorghum+Jantar differed significantly in G.F.Y. It yielded higher green fodder (72.68 t/ha) followed by Sorghum+Guar of 70.75 t/ha G.F.Y.

### **Evaluation Of Sorghum Lines/Varieties For Ratooning Potential**

This trial was conducted to find out evaluation of sorghum lines/varieties for ratooning potential. Eight lines/varieties namely PVK-801, FRI07,S-145,JS-1,SGD-01-17 SGD-02-16,NO5017, Sorghum 2011 were used. The system of lay out was RCBD with 4 replications having plot size of 2.7x6m.It was sown in the month of April. Data regarding G.F.Y was recorded and is given below.

<b>Treatments</b>	<b>Green Fodder Yield (t/ha)</b>
<b>T1 –PVK-801</b>	43.98
<b>T2 -FRI-07</b>	43.55
<b>T3 –S-145</b>	46.65
<b>T4 JS-1</b>	62.93
<b>T5- SGD-01-17</b>	45.41
<b>T6- SGD-02-16</b>	49.44
<b>T7- NO5017</b>	50.37
<b>T8-Sorghum-2011</b>	52.23
<b>LSD 5%</b>	0.9477

A new promising line of sorghum JS-1 different significantly in green fodder yield. It Yielded higher GFY (62.93t/ha) followed by Sorghum-2011 with GFY of (52.23t/ha).

### **Effect Of Seed Rate On Seed Production Of Berseem Lines Sb-1- 17&Sb-4-17**

This trial was conducted to find out optimum seed rate for maximum seed production of promising lines of berseem. Two promising lines of berseem namely SB-1-17&SB—4-17 were used. Seven seed rates 10.0, 12.5, 15.0, 17.5, 20.0, 22.5 and 25.0kg/ha were used . The system of lay out was split plot design with 4 replications having plot size of 3mx6m.It was sown in the month of October. Data regarding seed production was recorded and is given below.

<b>Treatments Seed rate (kg/ha)</b>	<b>Seed Yield (t/ha)</b>
<b>10.0</b>	0.810
<b>12.5</b>	0.852
<b>15.0</b>	0.894
<b>17.5</b>	0.936
<b>20.0</b>	0.964
<b>22.5</b>	0.866
<b>25.0</b>	0.824
LSD 0.05	2.807E-03

<b>Treatments Seed rate (kg/ha)</b>	<b>Seed Yield (t/ha)</b>
<b>10.0</b>	0.825
<b>12.5</b>	0.867
<b>15.0</b>	0.923
<b>17.5</b>	0.951
<b>20.0</b>	0.979
<b>22.5</b>	0.895
<b>25.0</b>	0.840
LSD 0.05	2.30E-03

Two new promising lines SB-1-17 & SB-4-17 differed significantly in seed production yield at different seed rates. Both the lines yielded higher seed yield (0.964t/ha) and (0.979t/ha) in seed rate (20kg/ha). followed by Seed yield of (0.936t/ha )and (0.951t/ha) at seed rate of 17.5 (kg/ha) in SB-1-17 line and SB-4-17 line respectively.

#### **Effect Of Different Fodder Crops Rotation On Root Rot Of Berseem**

This trial was conducted to study the suitable crop rotation for control of root rot disease of berseem. Four crop rotations **were used**.

### **Crop rotation**

**1-Maize –berseem –sorghum berseem**

**2- sorghum-berseem -sorghum-berseem**

**3-millet –berseem –sorghum –berseem**

**4-sorghum- oats-sorghum-berseem .**

The

system of lay out was RCBD with 4 replications having plot size of 3.6x6m. It was sown in the month of October. Data regarding disease incidence & G.F.Y was recorded and is given below.

<b>Treatments</b>	<b>Root Rot (%)</b>
Sorghum-Berseem	13.00
Sorghum-Berseem	14.50
Sorghum-Berseem	14.00
Sorghum-Berseem	9.00
LSD 5%	1.2924

<b>Treatments</b>	<b>GFY(t/ha)</b>
Sorghum-Berseem	98.00
Sorghum-Berseem	96.50
Sorghum-Berseem	97.00
Sorghum-Berseem	100.00
LSD 5%	2.4867

Crop rotation Sorghum -Oats-Sorghum-Berseem was least affected by root rot (9%) and gave higher GFY (100t/ha)

### **Effect Of Seed Rate On Fodder Production Of Alfalfa Promising Line 7613**

This trial was conducted to find out optimum seed rate for maximum fodder production of promising line of Alfalfa. . Seven seed rates 10.0, 12.5, 15.0, 17.5, 20.0, 22.5 and 25.0kg/ha were used . The system of lay out was RCBD with 4 replications having plot size of 2.7mx6m. It was sown in the month of October. Data regarding GFY was recorded and is given below.

Seed rate(kg/ha)	Fodder production (t/ha)
<b>5.0</b>	73.50
<b>7.5</b>	66.25
<b>10.0</b>	76.00
<b>12.5</b>	81.00
<b>15.0</b>	79.00
<b>17.5</b>	73.00
<b>20.0</b>	78.00
LSD 0.05	3.1407

Data regarding GFY indicated that a new promising line of Alfalfa (7613) gave maximum GFY (81.00t/ha) at a seed rate of 12.5kg/ha followed by seed rate of 15kg/ha with GFY (79t/ha).

#### **Comparison Of Ratooning Ability Of Oats Lines And Its Impact On Seed Production**

This agronomic trial was conducted to find out the maximum economic output through fodder and seed production of oats. Four varieties/lines S-2000, SGD-Oats-2011, Super green, Evergreen were used. The system of lay out was RCBD with four replication having Plot size of 2.7x6m. It was sown in the month of October. Data regarding G.F.Y and seed yield was recorded and is given below.

Treatment(Variety)		
	Fodder production(t/ha)	Seed production(t/ha)
<b>S-2000</b>	29.01	30
<b>SGD-Oats-2011</b>	31.94	35
<b>Super green</b>	32.25	40
<b>Evergreen</b>	33.95	45
LSD0.05	1.5190	3.9326

Data regarding GFY and seed yield indicated that a new promising line of oats Evergreen gave maximum GFY (33.95t/ha) and seed yield (45t/ha)

#### **Effect Of Sowing Methods On Fodder Production Of Promising Line Of Alfalfa 7613**

This agronomic trial was conducted to find out optimum sowing method for maximum fodder production. Four sowing methods namely broad cast, 15cm, 30cm and 45cm **were used**. The system of lay out was RCBD with 4 replications having plot size of 2.7x6m. It was sown in the month of October. Data regarding G.F.Y was recorded and is given below.

<b>Sowing method</b>	<b>Fodder production(t/ha)</b>
<b>Broadcast</b>	45.00
<b>15cm</b>	35.50
<b>30cm</b>	38.25
<b>45cm</b>	32.00
<b>LSD 5%</b>	3.1403

Data regarding GFY indicated that a new promising line of Alfalfa (7613) gave maximum GFY (45t/ha) with the sowing method of broadcast followed by 30cm with GFY (38.25t/ha)

#### **Effect Of Sowing Date On Seed Production Of Berseem New Line Sb-1-17**

This agronomic trial was conducted to find out the optimum sowing date for seed production of a new promising line SB-1-17 .Eight sowing dates namely 25<sup>th</sup> September ,5<sup>th</sup> October,15<sup>th</sup> October ,25<sup>th</sup> October ,5<sup>th</sup> November,15<sup>th</sup> November,25<sup>th</sup> November,5<sup>th</sup> December. The system of lay out was RCBD with four replication having Plot size of 2.7x6m. Data regarding seed yield was recorded and is giving below.

<b>Date of sowing</b>	<b>Seed Yield (t/ha)</b>
<b>25<sup>th</sup>September</b>	0.62
<b>5<sup>th</sup> October</b>	0.65
<b>15<sup>th</sup> October</b>	0.68
<b>25<sup>th</sup> October</b>	0.76
<b>5<sup>th</sup> November</b>	0.74
<b>15<sup>th</sup> November</b>	0.90
<b>25<sup>th</sup> November</b>	0.77
<b>5<sup>th</sup> December</b>	0.74
<b>LSD0.05</b>	0.261

Data regarding Seed yield indicated that a new promising line of berseem SB-1-17 gave maximum seed yield (0.90t/ha) with sowing date of 15<sup>th</sup> November followed by 25<sup>th</sup> November with seed yield of (0.77t/ha)

#### **Comparison Of Wheat Yield Sown After Different Fodder Crops**

This agronomic trial was conducted to find out the best cropping pattern of Wheat-Fodder crops. Four cropping patterns namely Lucerne-Wheat, Sorghum-Wheat, Maize-Wheat, Pearl millet-Wheat were used. . The system of lay out was RCBD with four replication having Plot size of 2.7x6m. It was sown in the month of November. Data regarding grain yield was recorded and is giving below.



Cropping pattern	Grain production(t/ha)
Lucerne-wheat	5.00
Sorghum-wheat	3.20
Maize-wheat	3.50
Pearl Millet-wheat	3.10
LSD 5%	<b>0.290</b>

Data regarding grain yield indicated that cropping pattern Lucerne –Wheat gave maximum grain yield (5.00t/ha) followed by cropping pattern Maize-Wheat with grain yield of (3.50t/ha)

### **SOIL SCIENCE KHARIF-2020**

#### **Performance evaluation of pearl millet germplasm on salt affected soil**



For the evaluation of the performance of Pearl Millet germplasm against soil salinity in natural field conditions and to find out the Comparatively Salt Tolerant lines, Moderately salt Tolerant lines and Salt Sensitive lines of Pearl Millet, a trial was conducted with the collaboration of the scientists of Soil Salinity Research Institute, Pindi Bhattian at their Research Area. Twelve lines of pearl millet were tested in RCBD with 4 replications having plot size 1.8x5 m. the data is given below.

Table Showing Germination (%), Mortality (%) and Green Fodder Yield (t ha<sup>-1</sup>) of different accessions of Pearl Millet.

Treatments	Lines	Germination %	Mortality %	GFY t ha-1
Comparatively Salt Tolerant				
T2	Composite- II	94	0	26.58
T3	Composite- IV	92	0	25.72
T6	RCBK-948	92	0	25.09
T9	Q-Bajra	91	0	24.88

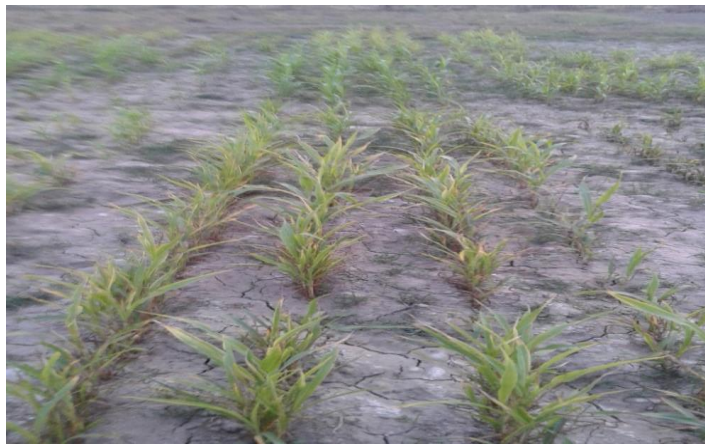
T10	BS-2000	93	0	24.17
T11	Sgd. Bajra 2011	91	0	24.01
Medium Salt Tolerant				
T1	Composite-I	76	0	20.73
T5	GJ Bajra	74	0	20.10
T8	CZK 923	72	0	18.03
Salt Sensitive Lines				
T4	Wt-Bajra	23	0	6.90
T7	Y-84	22	0	6.85
T12	MB-87	13	0	5.1

Soil Analysis Before Sowing:

Soil Texture	ECe (mScm-1) (Range)	pH (Range)	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)	SAR (meL <sup>-1</sup> ) <sup>1/2</sup>
Sandy Loam	3.70-6.20	8.74-9.10	0.60	6.7	124	28-45.68



### **Performance Evaluation Of Sorghum Germplasm On Salt Affected Soil**



For the evaluation of the performance of Sorghum (Fodder) germplasm against soil salinity in natural field conditions and to find out the Comparatively Salt Tolerant lines, Moderately salt Tolerant lines and Salt Sensitive lines of Sorghum, this trial was conducted with the collaboration of the scientists of Soil Salinity Research Institute, Pindi Bhattian at their Research Area. Twelve lines of Sorghum were tested in RCBD with 4 replications having plot size 1.8x5 m. the data is given below.

Table Showing Germination (%), Mortality (%) and Green Fodder Yield (t ha<sup>-1</sup>) of different accessions of Sorghum.

Treatments	Lines	Germination %	Mortality %	G.F.Y t ha <sup>-1</sup>
Comparatively Salt Tolerant Lines				
T10	PVK-801	78	0	25.6
T1	YS-98	77	0	25.1
T12	S-145	77	0	24.9
T8	NO-80010	76.90	0	24.4
T7	N0.1572	76.6	0	24.4
T11	FRI-07	75.4	0	23.8
T2	SGD-013-1	75	0	22.4
Medium Salt Tolerant Lines				
T3	Sgd-013-2	49	0	19.1
T5	Hegari	47	0	17.6
Salt Sensitive Lines				
T4	Sorghum-2011	20.8	0	10.4
T6	JS-2002	18.9	0	9.8
T9	I-6	18.6	0	9.1

Soil Analysis Before Sowing:

Soil Texture	ECe (mScm-1) (Range)	pH (Range)	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)	SAR (meL <sup>-1</sup> ) <sup>1/2</sup>
Sandy Loam	3.57-6.23	8.55-8.93	0.68	6.2	118	29.03-56.57

#### Screening Of Pearl Millet Germplasm Against Salinity Levels





For the Screening of different lines/ accessions Pearl Millet against different salinity levels a pots experiment was conducted at soil science Laboratory, Fodder Research Institute, Sargodha. The main objective of this experiment was to screen out the comparatively Salt Tolerant lines, Moderately Salt Tolerant Lines and Salt Sensitive Lines of Pearl Millet Germplasm. Different soil salinity levels were developed in pots having 10 Kg soil in each pot by using the salts named Sodium Chloride (NaCl), Sodium Sulphate ( $\text{Na}_2\text{SO}_4$ ), Calcium Chloride ( $\text{CaCl}_2$ ) and Magnesium Sulphate ( $\text{MgSO}_4$ ).



Ten lines of Sorghum were tested in CRD 2Factorial with 3 replications in pots experiment having different salinity levels. Data regarding Germination % and Mortality % has been given in the table below;

Comparatively Salt Tolerant Lines
-----------------------------------

Salinity Levels	Composite-II T5		BS-2000 T4		Q-Bajra T2	
	Germination %	Mortality %	Germination %	Mortality %	Germination %	Mortality %
Control	100	0	100	0	100	0
1.93 dSm <sup>-1</sup>	100	0	100	0	100	0
4 dSm <sup>-1</sup>	97	0	95	0	95	0
8 dSm <sup>-1</sup>	95	0	93	0	94	0
10 dSm <sup>-1</sup>	91	3	90	6	86	8
13 dSm <sup>-1</sup>	85	8	80	9	80	13
16 dSm <sup>-1</sup>	81	11	80	14	80	17
Medium Salt Tolerant Lines						
Salinity Levels	Composite-IV T7		Composite-I T6		CZK-923 T1	
	Germination %	Mortality %	Germination %	Mortality %	Germination %	Mortality %
Control	100	0	100	0	100	0
1.93 dSm <sup>-1</sup>	100	0	100	0	100	0
4 dSm <sup>-1</sup>	60	14	56	17	54	20
8 dSm <sup>-1</sup>	54	20	51	22	52	25
10 dSm <sup>-1</sup>	53	27	51	30	52	33
13 dSm <sup>-1</sup>	51	27	50	32	49	37
16 dSm <sup>-1</sup>	51	29	49	36	48	40

Salt Sensitive Lines								
	POP-98 T3		G-Bajra T8		G-White T9		Gahi T10	
	Germination %	Mortality %	Germination %	Mortality %	Germination %	Mortality %	Germination %	Mortality %
Control	100	0	100	0	100	0	100	0
1.93 dSm <sup>-1</sup>	70	0	69	0	65	0	61	0
4 dSm <sup>-1</sup>	45	21	42	27	41	26	41	27
8 dSm <sup>-1</sup>	39	27	35	31	33	36	31	38
10 dSm <sup>-1</sup>	21	29	20	36	20	38	18	41
13 dSm <sup>-1</sup>	13	35	11	42	8	49	8	55
16 dSm <sup>-1</sup>	4	49	3	57	2	63	2	69

### **Response of new maize line ms-04-2016 to npk fertilizers for Maximum grain yield**

This trial was conducted to find out the best combination of NPK fertilizers for obtaining

maximum grain yield of new maize line MS-04-2016. The trial was conducted in RCBD plan with 3 replications and 05 treatments level of N.P.K levels. Data was recorded at 50 % flowering . the results are given below.

Treatments NPK kg /ha	Grain Yield kg/ha	100 grain weight (g)
T1 = 70 - 60 - 42	1690.7	19.933
T2 = 80 - 70 – 52	2248.1	21.067
T3 = 90 - 80 – 62	2422.2	21.933
T4 = 100 - 90 – 72	2475.9	22.800
T5 = 110 - 100 - 82	2053.7	22.100
LSD 0.05	14.93	2.29

Treatment No. 4 (T4 = 100 - 90 – 72) performed better as it has produced maximum grain yield 2475.9 kg/ha and 22.800g 100 grains weight.

Soil Analysis Before Sowing:					
Soil Texture	ECe (mScm-1)	pH	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)
Silty Loam	0.71	7.8	0.60	6.7	124

#### **Response of new pearl millet line q-bajra to npk fertilizers For maximum grain yield**

This trial of Pearl Millet was conducted to find out the best combination of NPK fertilizers for obtaining maximum grain yield of new pearl millet line Q-Bajra. The Trial was conducted in RCBD plan with 3 replications having five treatments regarding different levels of N.P.K doses.

Data was recorded at 50 % flowering . the results are given below.

Treatments NPK kg /ha	Grain Yield kg/ha	1000 grain weight (g)
T <sub>1</sub> = 50 - 40 - 30	924	8.36
T <sub>2</sub> = 60 - 50 – 40	1052	9.00
T <sub>3</sub> = 70 - 60 – 50	1126	10.23
T <sub>4</sub> = 80 - 70 – 60	1067	10.03
T <sub>5</sub> = 90 - 80 - 70	1031	09.23
LSD 0.05	13.24	0.59

Treatment No. 3 ( $T_3 = 70 - 60 - 50$ ) performed better as it has produced maximum grain yield which is 1126 Kg/ha.

Soil Analysis Before Sowing:

Soil Texture	ECe (mScm-1)	pH	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)
Silty Loam	0.83	7.6	0.72	6.3	148

#### **Response of new maize line ms-04-2016 to npk fertilizers for Maximum green fodder yield**

This Maize trial was conducted to find out the best combination of NPK fertilizers for obtaining maximum green fodder yield of new Maize line MS-04-2016. The Trial was conducted in RCBD plan with 3 replications having five treatments regarding different levels of N.P.K doses. Data was recorded at 50 % flowering . the results are given below.

Treatments NPK kg /ha	Green Fodder Yield t/ha	Dry Matter %
T1 = 66 - 56 - 29	51.47	18.3
T2 = 78 - 68 - 36	54.62	18.7
T3 = 90 - 80 - 43	61.48	19.6
T4 = 102 - 92 - 50	59.44	19.2
T5 = 114- 104 - 57	56.47	18.9
LSD 0.05	3.78	0.31

Soil Analysis Before Sowing:

Soil Texture	ECe (mScm-1)	pH	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)
Silty Loam	0.79	7.3	0.76	6.9	131

#### **Response of new pearl millet line q- bajra to npk fertilizers for Maximum green fodder yield**

This Pearl Millet trial was executed to find out the best combination of NPK fertilizers for obtaining maximum green fodder yield of new pearl millet line Q-Bajra. The Trial was conducted in RCBD plan with 3 replications having five treatments regarding different levels of N.P.K doses. Data was recorded at 50 % flowering . the results are given below.

PREVIOUS YEAR'S RESULTS;

Treatments NPK kg /ha	Green Fodder Yield t/ha	Dry Matter %
T <sub>1</sub> = 46 - 36 - 27	48.14	15.07
T <sub>2</sub> = 58 - 48 - 32	49.63	16.00
T <sub>3</sub> = 70 - 60 - 37	54.81	16.17
T <sub>4</sub> = 82 - 72 - 42	53.51	17.70
T <sub>5</sub> = 94 - 84 - 47	54.62	18.03
LSD 0.05	12.03	0.31

Soil Analysis Before Sowing:

Soil Texture	ECe (mScm-1)	pH	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)
Silty Loam	0.79	7.3	0.76	6.9	131

**Response of new sorghum line fri-07 to npk fertilizers for maximum Green fodder yield**

This New line (FRI-07) of Sorghum was tested against different levels of NPK Fertilizers doses to find out the best combination of NPK fertilizers for obtaining maximum green fodder yield of new pearl millet line FRI-07. The Trial was conducted in RCBD plan with 3 replications having five treatments regarding different levels of N.P.K Fertilizers doses. Data was recorded at 50 % flowering . the results are given below.

Treatments NPK kg /ha	Green Fodder Yield t/ha	Dry Matter %
T <sub>1</sub> = 56 - 33 - 28	53.3	16.2
T <sub>2</sub> = 68 - 45 - 34	54.4	16.4
T <sub>3</sub> = 80 - 57 - 40	54.8	16.5
T <sub>4</sub> = 92 - 69 - 46	57.4	17.3
T <sub>5</sub> = 104 - 81 - 52	55.7	16.9
LSD 0.05	1.45	N.S

Soil analysis before sowing:

Soil Texture	ECe (mScm-1)	Ph	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)



Silty Loam	0.83	7.9	0.59	6.8	143
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### **Effect of different concentration of npk as foliar spray on Growth and yield of maize**

This trial of foliar spray on Maize was executed to find out the best economical dose of NPK as foliar spray with Basal dose to obtain maximum green fodder yield of maize. Phosphorous was applied at the time of sowing while nitrogen was applied in split along with irrigation.

Foliar applications were applied after ten days interval. The Trial was conducted in RCBD plan with 3 replications The following observations were recorded.

Treatments NPK kg /ha	Green Fodder Yield t/ha	Dry Matter %
T1= 90-80-25 (NPK kg ha <sup>-1</sup> basal dose)	70.7	17.19
T2= NPK basal dose+ 2gLit <sup>-1</sup> NPK foliar spray	72.5	17.29
T3= NPK basal dose +4 g Lit <sup>-1</sup> NPK foliar spray	73.1	17.38
T4= NPK basal dose +6 g Lit <sup>-1</sup> NPK foliar spray	74.9	17.53
T5= NPK basal dose + 8 g Lit <sup>-1</sup> NPK foliar spray	74.2	17.43
LSD 0.05	1.23	N.S.

Soil analysis before sowing:

Soil Texture	ECe (mScm-1)	pH	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)
Silty Loam	0.68	6.9	0.79	6.1	129

### **Nutritional Quality Assessment of Kharif Fodders**

This trial was executed to analyze the nutritional status of different lines of different fodder crops. For this purpose 10 lines from each fodder of kharif season like Sorghum, Pearl Millet and Maize were selected for the analysis against different quality parameters . Samples were collected at critical stage of each crop. The analysis was carried out through Biochemistry section of AARI, Faisalabad. The quality data is given below

PEARL MILLET					
Varieties / lines	DM %	Ash (%)	Crude Fat (%)	Crude Fiber (%)	Crude Protein (%)
Composite IV	16.6	7.49	3.23	21.3	9.22
Q-bajra	13.7	7.50	3.77	23.0	9.36
G-bajra	14	7.40	3.58	21.1	10.2
Sgd 2011	12.7	8.35	3.30	22.8	9.51
POP-6	15	7.71	3.49	18.9	9.45
Composite-II	14.2	8.46	3.45	20.9	9.97
Composite-I	12.4	7.54	3.53	22.0	9.42
BS-99	13.2	7.86	3.95	20.1	9.42
Sen Pop	11.9	<u>8.90</u>	<u>3.82</u>	<u>20.2</u>	<u>9.02</u>
Hi Group	14.4	9.40	3.54	22.3	8.90
G.T. Bajra	14.6	7.72	3.37	20.2	9.51
Synthetic-89	13.8	6.40	3.42	20.2	10.1
WT Bajra	14	8.57	3.34	21.3	10.1
BS-2000	12.2	6.65	3.25	22.2	9.01
Q. Bajra	11.9	6.51	3.66	21.0	9.33
<u>Range</u>	11.9 To 16.6	6.51 9.40	3.23 3.95	18.9 23.0	8.90 10.1

SORGHUM					
Varieties / lines	DM %	Ash (%)	Crude Fat (%)	Crude Fiber (%)	Crude Protein (%)
F-01-2017	20.5	7.21	2.55	25.8	11.9
F-02-2017	18.5	8.11	2.93	25.5	12.2
Sgd-01-017	17	9.03	2.39	28.9	13.5
Sgd-02-017	18.5	7.43	2.45	31.4	13.8
No. 517	16	7.61	2.14	31.4	13.7
PARC-SS-1	16	9.60	2.32	29.5	13.8
B-203	19.5	8.77	2.61	27.3	12.9
Y-SS-15	20.5	8.62	2.89	26.6	12.7
FRI-07	21.4	9.50	2.89	28.4	13.6
Sgd-013 1	19.3	8.25	2.90	23.7	11.6
Sgd-013 2	19.2	9.18	2.59	23.0	11.6
Sorghum 2011	20.1	9.24	2.66	28.1	13.3
Range	16.0 to 21.4	7.21 9.60	2.14 2.93	23 31.4	11.6 13.8

<b>MAIZE</b>					
<b>Varieties / lines</b>	<b>DM %</b>	<b>Ash (%)</b>	<b>Crude Fat (%)</b>	<b>Crude Fiber (%)</b>	<b>Crude pro. (%)</b>
No. 15345	21.3	7.58	2.61	27.8	13.2
My corn	22.4	8.54	2.52	23.0	11.6
Malka	19.4	8.32	2.57	23.5	12.2
Sgd 2002	20.4	9.12	2.37	27.7	14.0
Super green	21.6	8.29	2.38	25.8	11.0
MMRI yellow	19.0	8.97	2.08	23.5	13.7
Pearl maize	18.1	9.16	2.88	26.3	12.2
P 3939	19.2	7.72	2.66	23.2	11.9
MS 04 16	23.2	9.55	3.27	25.1	13.6
No. 15262	18.6	7.76	2.49	23.7	11.4
YH 1898	19	8.25	2.68	26.3	12.8
No 19185	19.8	7.63	2.54	22.5	11.7
No 15264	20	7.94	2.11	23.9	10.8
No 15266	21.2	8.11	2.76	24.5	10.3
No 15355	20.2	7.34	2.77	26	11.5
No 15332	20.6	8.08	2.52	23.7	12.2
No 15326	20.2	8.06	2.19	23.3	13.2
<b>Range</b>	18.1 To 23.2	<b>7.34</b> <b>9.55</b>	<b>2.08</b> <b>2.88</b>	<b>22.5</b> <b>27.8</b>	<b>10.3</b> <b>13.7</b>

## **SOIL SCIENCE RABI (2020-21)**

### **Standardization Of Fertilizer Dose For Oats Lines (Ck-1& Fri-01) To Obtain Maximum Green Fodder Yield**

Two New lines (CK-1 & FRI-01) of Oats were tested against different levels of NPK Fertilizers doses to find out the best combination of NPK fertilizers for obtaining maximum green fodder yield of new lines of Oats. The Trial was conducted in split plot Design plan with 3 replications having Six treatments regarding different levels of N.P.K Fertilizers doses. The plot size was 18m<sup>2</sup> and row spacing was 30 cm. Data was recorded at 50 % flowering . the results are given below.

<b>Treatments</b>	<b>Green fodder yield ( tha<sup>-1</sup>)</b>		<b>Dry Matter %</b>	
	<b>CK-1</b>	<b>FRI-01</b>	<b>CK-1</b>	<b>FRI-01</b>
<b>T1= 00-00-00 NPK kg ha<sup>-1</sup></b>	56.67	60.19	<b>15.05</b>	<b>16.98</b>
<b>T2= 102-76-56 NPK kg ha<sup>-1</sup></b>	69.63	69.81	<b>17.30</b>	<b>17.29</b>

T3= 108-80-59 NPK kg ha <sup>-1</sup>	74.44	76.48	17.53	17.77	
T4= 114-84-62 NPK kg ha <sup>-1</sup>	77.78	79.81	17.90	18.10	
T5= 120-88-65 NPK kg ha <sup>-1</sup>	77.04	78.70	17.88	17.97	
T6= 126-102-68 NPK kg ha <sup>-1</sup>	76.85	78.15	17.81	17.92	
LSD 0.05 (Fertilizer x Variety)	2.98		0.29		
Soil Analysis Before Sowing					
Soil Texture	ECe (mScm-1)	pH	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)
Clay Loam	0.81	7.7	0.78	6.1	144

#### **Standardization Of Fertilizer Dose For Berseem Line (Sb-1-17) To Obtain Maximum Green Fodder Yield**

This trial was designed to find out the best combination of NPK fertilizer doses to obtain maximum green fodder yield of Berseem line SB-1-17. The Trial was conducted in RCBD plan with 3 replications having six treatments regarding different levels of N.P.K doses. Data was recorded just before each cutting . The results are given below.

<b>Treatments</b>	<b>Green Fodder Yield (tha<sup>-1</sup>) 4 Cuts</b>
<b>T1=00-00-00 NPK Kgha<sup>-1</sup></b>	56.1
<b>T2=21-70-40 NPK Kgha<sup>-1</sup></b>	76.5
<b>T3=22-75-45 NPK Kgha<sup>-1</sup></b>	82.0
<b>T4=23-80-50 NPK Kgha<sup>-1</sup></b>	90.2
<b>T5=24-85-55 NPK Kgha<sup>-1</sup></b>	88.5
<b>T6=25-90-60 NPK Kgha<sup>-1</sup></b>	88.7
<b>LSD 0.05</b>	1.22

<b>Soil Analysis Before Sowing</b>					
<b>Soil Texture</b>	<b>ECe (mScm -1)</b>	<b>pH</b>	<b>Organic Matter %</b>	<b>Available phosphorous (mg kg-1)</b>	<b>Available potassium (mg kg-1)</b>
<b>Clay Loam</b>	<b>0.89</b>	<b>7.7</b>	<b>0.71</b>	<b>5.9</b>	<b>138</b>

### **Standardization Of Fertilizer Dose For Berseem Line (Sb-4-17) To Obtain Maximum Green Fodder Yield**

This trial was designed to find out the best combination of NPK fertilizer doses to obtain maximum green fodder yield of Berseem line SB-4-17. The Trial was conducted in RCBD plan with 3 replications having six treatments regarding different levels of N.P.K doses. Data was recorded just before each cutting . The results are given below.

Treatments	Green Fodder Yield $\text{tha}^{-1}$ (4Cuts)
T1=00-00-00 NPK $\text{Kgha}^{-1}$	50.6
T2=21-68-45 NPK $\text{Kgha}^{-1}$	72.8
T3=22-72-48 NPK $\text{Kgha}^{-1}$	79.1
T4=23-76-51 NPK $\text{Kgha}^{-1}$	82.4
T5=24-80-54 NPK $\text{Kgha}^{-1}$	81.3
T6=25-84-57 NPK $\text{Kgha}^{-1}$	80.7
LSD 0.05	0.92

Soil Analysis Before Sowing;					
Soil Texture	ECe (mScm-1)	pH	Organic Matter %	Available phosphorous (mg kg-1)	Available potassium (mg kg-1)
Silty Loam	0.54	7.4	0.78	6.9	113

### **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
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#### **DAIRY TECHNOLOGY DIVISION**

#### **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 are explained below.

Parameters	T1 SGD-013-1	T2 SGD-013-2	T3 S-9901	T4 Sorghum-2011
Quantity fed (kg)	65.0	65.0	65.0	65.0
Voluntary feed intake (kg)	52.62A	50.75AB	49.87B	48.87B
LSD0.05				2.43
Palatability (%)	80.96A	78.07AB	76.73B	75.19B
LSD0.05				3.74

#### **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.

Parameters	Composite- IV	Q-Bajra	G-Bajra	Sargodha 2011	Bajra- 2011
Quantity Fed (kg)	65.0	65.0	65.0	65.0	
Voluntary Feed intake (kg)	52.75A	50.00AB	51.25 AB	48.75 B	
LSD 0.05					3.08
Palatability (%)	81.15A	76.92AB	78.84 AB	75.00B	
LSD 0.05					4.75

#### **Influence Of Plant Maturity Stages On Silage Quality Of Sorghum Cultivar In Dairy Bufaloes**

Silage was prepared from sorghum at different maturity stages i.e. Milky Stage (MS), Dough Stage (DS) and Physiologic Maturity Stage (PM)) according to standard method. The prepared sorghum

silage was analyzed for Dry matter %, crude protein %, fat %, Crude Fiber%, ash % and Nitrogen free Extract (NFE). The sorghum silages were fed to dairy buffaloes to see the effect of silage on milk quality and milk production. Dry matter was estimated for daily requirement of animals. Nine multiparous buffaloes of almost similar stage and lactation number was selected and fed on different silages of sorghum cultivar. Treatments were repeated thrice. Daily feed intake and milk yield was recorded. Data recorded was analyzed statistically.

<b>Proximate Composition of Sorghum Silages at Different Maturity Stages</b>			
	<b>T1. Milky Stage</b>	<b>T2. Dough stage</b>	<b>T3. Physiological Maturity stage</b>
<b>Dry Matter %</b>	23.31±0.35	25.46±0.75	28.82±0.97
<b>Crude Protein %</b>	11.5±0.91	11.41±0.45	10.88±0.62
<b>Crude Fat %</b>	1.96±0.10	2.23±0.13	2.74±0.13
<b>Crude Fiber %</b>	28.13±0.65	26.33±3.06	23.74±0.95
<b>Ash %</b>	9.01±0.10	8.95±0.22	8.54±0.57
<b>NFE %</b>	49.4±0.48	51.06±3.00	54.08±1.85

<b>EFFECT OF SORGHUM SILAGE FEEDING ON MILK PRODUCTION AND FEED INTAKE</b>				
<b>Diet</b>	<b>Feed Offered (Kg)</b>	<b>Intake (Kg)</b>	<b>Milk production (Liters) Before Trial</b>	<b>Milk production (Liters) Before Trial</b>
<b>T1. Milky Stage</b>	30.0	23.40A	9.96A	10.46A
<b>T2. Dough stage</b>	30.0	21.16AB	8.50B	9.50B
<b>T3. Physiological Maturity stage</b>	30.0	19.83B	8.80B	9.53B
<b>LSD 0.05</b>		3.32	0.35	0.75

### EFFECT OF SORGHUM SILAGE FEEDING ON MILK QUALITY CHARACTERISTICS

Diet	Fat (%)	SNF (%)	T. Solids (%)	Protein (%)	Lactose (%)	Acidity (%)	pH
T1 Milky Stage	6.60B	7.90AB	14.50B	4.92A	3.96AB	0.09A	6.90 A
T2 Dough stage	6.86AB	7.25B	14.11B	4.23B	3.99A	0.08A	6.91A
T3 Physiological Maturity stage	7.06A	8.67A	15.74A	3.83B	3.66B	0.08A	6.91A
LSD 0.05	0.31	0.80	0.62	0.43	0.31	0.03	0.03

### Evaluation Of Maize Varieties For Silage Quality And Milk Production In Dairy Animals

Silage was prepared from different maize varieties i.e. Sargodha-2002, Super green maize, Malka, MMRI Yellow and Pearl according to standard method. The prepared maize silages was analyzed for Dry matter %, crude protein %, fat %, Crude Fiber%, ash % and Nitrogen free Extract (NFE). The maize silages were fed to dairy buffaloes to see the effect of silage on milk production. Dry matter was estimated for daily requirement of animals. Multiparous buffaloes of almost similar stage and lactation number was selected and fed on different silages of maize varieties. Daily feed intake and milk yield was recorded. Data recorded was analyzed statistically.

### Proximate Composition Of Different Maize Varieties Silages

	Dry Matter %	Crude Protein %	Crude FAT %	Crude Fiber %	Ash%
Pearl maize	32.96±1.67	7.74±0.57	1.46±0.18	24.80±0.60	6.78±0.73



<b>MMRI Yellow</b>	33.18±2.47	6.97±0.63	2.04±0.14	26.17±1.15	6.71±0.39
<b>Super Green Maize</b>	34.33±2.04	7.87±0.19	1.75±0.11	29.24±0.89	6.9±0.22
<b>Sgd.2002</b>	28.56±1.36	7.14±0.13	1.85±0.23	28.78±1.39	5.52±0.23
<b>Malka</b>	32.26±1.41	7.97±0.70	1.15±0.10	22.64±0.74	5.70±0.63

#### Effect Of Maize Silage Feeding On Milk Production And Feed Intake

<b>Diet</b>	<b>Feed Offered (Kg)</b>	<b>Intake (Kg)</b>	<b>Milk production (Liters) Before Trial</b>	<b>Milk production (Liters) Before Trial</b>
<b>T1. Silage of Pearl maize</b>	25.0	19.50AB	8.13A	8.80BC
<b>T2. Silage of MMRI Yellow</b>	25.0	20.23AB	7.73A	8.56C
<b>T3. Silage of Super Green Maize</b>	25.0	21.70A	8.46A	9.90A
<b>T4. Silage of Sgd.2002</b>	25.0	19.53AB	7.96A	9.10B
<b>T5. Silage of Malka</b>	0.25	18.43B	8.23A	9.20B
<b>LSD 0.05</b>		2.39	0.76	0.51

#### EFFECT OF MAIZE SILAGE FEEDING ON MILK QUALITY CHARACTERISTICS

<b>Diet</b>	<b>Fat (%)</b>	<b>SNF (%)</b>	<b>T. Solids (%)</b>	<b>Protein (%)</b>	<b>Lactose (%)</b>	<b>Acidity (%)</b>	<b>pH</b>
<b>T1. Silage of Pearl maize</b>	6.55B	8.67AB	15.23A	3.87B	4.12A	0.08A	6.91A
<b>T2. Silage of MMRI Yellow</b>	7.25A	7.98BC	15.24A	3.75B	3.36D	0.08A	6.92A
<b>T3. Silage of Super Green Maize</b>	6.73B	7.90C	14.64AB	3.52C	3.73BC	0.08A	6.91A
<b>T4. Silage of Sgd.2002</b>	6.16C	7.88C	14.043B	3.74B	3.64C	0.09A	6.91A
<b>T5. Silage of Malka</b>	6.73B	8.83A	15.563A	4.11A	3.91AB	0.08A	6.92A
<b>LSD 0.05</b>	0.28	0.71	0.96	0.20	0.22	0.02	0.02

#### DAIRY TECHNOLOGY SECTION RABI TRIALS

## **EFFECT OF BERSEEM AND ALFALFA HAY ON MILK PRODUCTION AND COMPOSITION OF DAIRY BUFFALOES**

The hay of Berseem and Alfalfa was prepared by standard method and analyzed for proximate composition. The hay was fed to buffaloes to determine its effect on milk production and Milk composition (Milk fat, SNF, Total Solids, Protein, Lactose, pH, Acidity). Eight dairy buffaloes of almost similar stage and lactation number was selected and fed on different types of hay at ad-libitum. Daily feed intake and milk yield was recorded. The data was analyzed statistically.

<b>Proximate Composition of Berseem and Alfalfa Hay</b>			
<b>Sr. #</b>	<b>Parameters</b>	<b>Berseem Hay</b>	<b>Alfalfa Hay</b>
<b>1</b>	<b>DM (%)</b>	88.9±1.10	89.2±2.00
<b>2</b>	<b>Moisture (%)</b>	11.1±1.11	10.8±2.00
<b>3</b>	<b>Ash (%)</b>	11.13±0.10	10.62±0.14
<b>4</b>	<b>Crude Protein (%)</b>	16.67±0.30	21.06±0.30
<b>5</b>	<b>Crude Fat (%)</b>	1.97±0.10	2.09±0.13
<b>6</b>	<b>Crude Fiber (%)</b>	19.5±2.0	20.5±0.60
<b>7</b>	<b>NFE (%)</b>	39.63±2.34	34.92±2.56

<b>Diet</b>	<b>Milk Production (Liters)</b>	
	<b>Before Trial</b>	<b>After Trial</b>
<b>T1 (Berseem Hay)</b>	<b>6.85 A</b>	<b>7.70 A</b>
<b>T2 (Alfalfa Hay)</b>	<b>7.05 A</b>	<b>7.75 A</b>
<b>LSD 5%</b>	<b>0.76</b>	<b>0.37</b>

<b>Feed Intake and Milk Composition</b>			
<b>Parameter</b>	<b>T1 (Berseem Hay)</b>	<b>T2 (Alfalfa Hay)</b>	<b>LSD 0.05</b>
<b>Feed Intake (Kg)</b>	9.80 A	7.30 B	0.68
<b>Fat (%)</b>	7.14 A	5.90 B	1.18
<b>SNF (%)</b>	7.52 A	9.19 A	2.14
<b>TSS (%)</b>	14.67 A	15.09 A	1.90
<b>Density</b>	25.72 A	33.80 A	9.15
<b>Lactose (%)</b>	3.51 A	4.07 A	0.96
<b>Salts (%)</b>	0.53 B	0.66 A	0.11
<b>Protein (%)</b>	3.48 A	4.19 A	1.02

<b>pH</b>	6.91 A	6.91 A	0.018
<b>Acidity (%)</b>	0.08 A	0.08 A	0.018
<b>Freezing Point</b>	-0.425 A	-0.530 A	0.11

## **NUTRITIONAL EVALUATION OF VARIOUS STAGES OF MATURITY OF OAT HAY AND ITS EFFECT ON MILK PRODUCTION AND COMPOSITION**

The hay of oats at various stages of maturity (Boot Stage, Flowering stage, Dough stage) was prepared by standard method and analyzed for proximate composition (DM %, Crude protein %, Crude fat %, Crude Fiber %, Ash %). The hay was fed to buffaloes to determine its effect on milk production and Milk composition (Milk fat, SNF, Total Solids, Protein, pH, Acidity). Nine dairy buffaloes of almost similar stage and lactation number was selected and fed on different types of oat hay at ad-libitum. Daily feed intake and milk yield was recorded. The data was analyzed statistically.

### **PROXIMATE COMPOSITION OF OAT HAY AT DIFFERENT MATURITY STAGES (Boot Stage, Flowering stage, Dough stage)**

<b>Sr. #</b>	<b>Parameters</b>	<b>T1 Oat Hay at Boot Stage</b>	<b>T2 Oat Hay at flowering stage</b>	<b>T3 Oat Hay at Dough stage</b>
<b>1</b>	<b>DM (%)</b>	88.73±1.72	88.0±1.05	89.26±0.95
<b>2</b>	<b>Moisture (%)</b>	11.26±1.72	12.0±1.05	10.73±0.95
<b>3</b>	<b>Ash (%)</b>	11.94±0.19	9.86±0.22	11.93±0.10
<b>4</b>	<b>Crude Protein (%)</b>	9.65±0.20	9.71±0.22	9.33±0.25
<b>5</b>	<b>Crude Fat (%)</b>	1.32±1.32	1.46±0.14	1.26±0.09
<b>6</b>	<b>Crude Fiber (%)</b>	26.46±6.02	23.73±2.65	22.73±2.00
<b>7</b>	<b>NFE (%)</b>	39.35±4.64	43.22±3.39	44.00±3.39

<b>Diet</b>	<b>Milk Production (Liters)</b>	
	<b>Before Trial</b>	<b>After Trial</b>
<b>T1. Oat Hay at Boot Stage</b>	6.73 A	7.50 A
<b>T2 Oat Hay at flowering stage</b>	6.76 A	7.43 A
<b>T3. Oat Hay at Dough stage</b>	6.73 A	7.36 A
<b>LSD 5%</b>	<b>0.590</b>	<b>0.523</b>

### **Feed Intake and Milk Composition**

<b>Parameter</b>	<b>T1 (Oat Hay at Boot Stage)</b>	<b>T2 (Oat Hay at Flowering Stage)</b>	<b>T3 (Oat Hay at Dough Stage)</b>	<b>LSD 0.05</b>
<b>Feed Intake (Kg)</b>	8.66B	9.66A	9.56A	0.50
<b>Fat (%)</b>	5.14 B	5.69 A	5.19 B	0.42
<b>SNF (%)</b>	8.17 B	8.26 B	10.44 A	0.49
<b>TSS (%)</b>	13.96 B	13.95 B	15.64 A	1.25
<b>Density</b>	30.97 B	31.24 B	39.99 A	6.23
<b>Lactose (%)</b>	3.93 B	3.86 B	4.67 A	0.52
<b>Salts (%)</b>	0.60 B	0.63 AB	0.72 A	0.10
<b>Protein (%)</b>	3.68 B	3.77 B	5.05 A	0.17
<b>pH</b>	6.91 A	6.92 A	6.92 A	0.02
<b>Acidity (%)</b>	0.09 A	0.08 A	0.08 A	0.02
<b>Freezing Point</b>	-0.43 A	-0.46 C	-0.46 B	5.85

**GUAR BREEDING RESEARCH STATION, BAHAWALPUR**

## **GUAR[*Cyamopsis tetragonoloba*(L.) Taub]**

### **BREEDING STUDIES**

#### **Collection, Evaluation and Maintenance Of Guar germplasm**

An experiment consisting of 349 genotypes/accessions of guar including one check was sown on 22.06.2020 according to Augmented Design. The experiment was harvested during November, 2020. 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**

<b>Sr. No.</b>	<b>Characters</b>	<b>Range</b>
1	Days to 50% flowering	45-70 days
2	Days to 90% maturity	110-160 days
3	Plant height	45-190 cm
4	Branches plant <sup>-1</sup>	0-18
5	Clusters plant <sup>-1</sup>	10-32
6	Pods plant <sup>-1</sup>	25-400
7	Pods cluster <sup>-1</sup>	3-14
8	Pod length	3-7cm
9	Seeds pod <sup>-1</sup>	3-10
10	1000-Seed weight	20-35gm
11	Green fodder yield	15-36 tons ha <sup>-1</sup>
12	Seed Yield	600-2700 Kg ha <sup>-1</sup>



**Figure 01: Evaluation and maintenance of guar germplasm**

#### **Hybridization Of Guar And Study Of Filial Generations**

To combat biotic (insect pests/ diseases), abiotic stresses (drought) and to improve seed 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.	BR-90 x S-6543	65	-
2.	S-6536 X BR-90	70	-
3.	BR-90 X S-6547	96	1
4.	S-6161 X S-6543	64	-
5.	S-5885 X S-6159	75	-
6.	BR-2017 x BR-90	92	-
7.	BR-90 X BR-2017	80	1
8.	BR-2017 X S-6384	53	-
9.	S-6543 X BR-2017	110	-
10.	S-6161 X S-5885	125	2
11.	S-5885 X BR-6536	45	-
12.	S-6384 X BR-2017	66	-

F<sub>0</sub> seed was harvested for growing F<sub>1</sub> during Kharif, 2021.

Furthermore, following generations were maintained during Kharif, 2020:

Generation	Parental Crosses/progenies studied	Crosses/plants/ progenies selected
F <sub>1</sub>	6 (Crosses)	3 (Crosses)
F <sub>2</sub>	2 (Crosses)	35 (Plants)
F <sub>3</sub>	40 (Progenies)	22 (Plants)
F <sub>4</sub>	5 (Progenies)	4 (Plants)



**Figure 02: Hybridization of guar**

### **Irradiation Of Guar Seed To Create Genetic Variability**

The seed of two Varieties/lines of guar BR-2017 and S-6159 was sent to NIAB, Faisalabad for its treatment with radiations at 05 different doses 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 24.06.2020 to raise M<sub>1</sub> Generation. Out of these 10 Mutants, 03 were selected to raise M<sub>2</sub> generation during Kharif, 2021. Following generation were studied during Kharif, 2020:

<b>Generation</b>	<b>Mutants/progenies studied</b>	<b>Mutants/plants/ progenies selected</b>
M <sub>1</sub>	10 (Mutants)	03 (Mutants)
M <sub>2</sub>	04 (Mutants)	20 (Plants)

### **Identification Of Promising Progeny Lines Of Guar**

An experiment consisting of 60 progenies and 40 superior progenies along with one check was sown on 22.06.2020. The similar agronomic practices were adapted throughout the growth period. The experiment was harvested during November, 2020. On the basis of good performance 19 superior progenies were selected for their evaluation in preliminary yield trials during Kharif, 2021. Furthermore, 50 new single plants were selected from available guar material to grow plant to progeny rows during Kharif, 2021.

	<b>Single plants/progenies studied</b>	<b>Single plants/progenies selected</b>
Selection of Single plants	-	50 (plants)
Selection of Superior progenies	60 (progenies)	36 (plants)
Final selection of better performing progenies for evaluation in replicated yield trials	40 (progenies)	19 (progenies)

**Table 3: Previous Year Results**

### **Preliminary Guar Yield Trials**

#### **Trial-I (A-I)**

A-I trial consisting of 11 strains including one check was sown on 23.06.2020. 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, 2020 and yield data were recorded which are given as under:

**Table 4: Results of Preliminary Guar Yield Trial -I (A-1)**

<b>Strains</b>	<b>Seed yield (Kg ha<sup>-1</sup>)</b>	<b>± % over check</b>
S-6733	2701	35.52

S-6752	2572	29.05
S-6728	2341	17.46
S-6723	2328	16.81
S-6724	2202	10.49
S-6754	2148	7.78
<b>BR-2017 (Check)</b>	<b>1993</b>	<b>0.00</b>
S-6732	1685	-15.45
S-6746	1492	-25.14
S-6755	1106	-44.51
S-6771	965	-51.58
LSD (0.05)	213.4	

The data showed that strain S-6733 gave the maximum seed yield of 2701kg ha<sup>-1</sup> (35.52% higher than check) followed by the strain S-6752 which gave 2572kg ha<sup>-1</sup> than check BR-2017 (1993 kg ha<sup>-1</sup>). The four strains S-6732, S-6746, S-6755 and S-6771 were the lowest yielders (965-1685kg ha<sup>-1</sup>) than the check variety BR-2017. Six strains S-6723, S-6724, S-6728, S-6733, S-6752 and S-6754 out yielded the check variety BR-2017 by 7.78% to 35.52% and were selected for evaluation in B-trial during the year 2021 on the basis of good performance. Highly significant differences were found among the mean values of the genotypes.



### Preliminary Guar Yield Trial -II (A-II).

A-II trial comprising of 09 strains including one check was sown on 23.06.2020. 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. The data were recorded for fodder yield during August, 2020 and for seed yield during November, 2020 which are given as under:

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

Strains	Seed yield (Kg ha <sup>-1</sup> )	± % over check	Fodder Yield (t ha <sup>-1</sup> )	± % over check
S-6740	2402	15.59	34.2	17.53



S-6731	2341	12.66	28.8	-1.03
S-6749	2197	5.73	30.6	5.15
S-6727	2166	4.23	25.5	-12.37
S-6744	2155	3.71	36.8	26.46
<b>BR-2017 (Check)</b>	<b>2078</b>	<b>0.00</b>	<b>29.1</b>	<b>0.00</b>
S-6765	1595	-23.24	34.0	17.87
S-6757	900	-56.69	22.6	-22.34
S-6767	628	-69.78	27.5	-5.50
LSD (0.05)	337.1		5.1	

As for as the seed yield is concerned, the strain S-6740 out yielded all the contestants and gave seed yield of 2402Kg ha<sup>-1</sup>(15.59% higher than check) followed by the variety S-6731 which produced 2341Kg ha<sup>-1</sup> as compared to check variety BR-2017(2078 Kgha<sup>-1</sup>). However, in case of fodder yield, strain S-6744 produced maximum fodder yield of 36.80 t ha<sup>-1</sup> followed by S-6740 (34.20 t ha<sup>-1</sup>) than check variety BR-2017(29.10 t ha<sup>-1</sup>). The five strains S-6727, S-6731, S-6740, S-6744 and S-6749 gave 03.71% to 15.59% higher seed yield than the check variety BR-2017. On the basis of good performance these five strains were selected for further evaluation in B-trials during the year 2021. Statistical analysis revealed highly significant differences among the mean values.

#### Regular Guar Yield Trial (B-Trial)

B-trial comprising of 11 strains including one check was sown on 23.06.2020. 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 data were recorded for fodder yield during August, 2020 and for seed yield during November, 2020 which are given as under:

**Table: 6 Results of Regular Guar Yield Trial**

Strains	Seed yield (Kg ha <sup>-1</sup> )	± % over check	Fodder Yield (t ha <sup>-1</sup> )	± % over check
S-6695	2829	44.71	34.00	10.71
S-6692	2675	36.83	32.84	6.94
S-6710	2649	35.50	35.37	15.17
S-6686	2515	28.64	36.27	18.10
S-6682	2508	28.29	31.38	2.18
S-6683	2114	8.13	34.31	11.72
<b>BR-2017 (Check)</b>	<b>1955</b>	<b>0.00</b>	<b>30.71</b>	<b>0.00</b>
S-6688	1698	-13.15	31.76	3.42
S-6698	1350	-30.95	25.98	-15.40
S-6719	1132	-42.10	26.49	-13.74
S-6701	733	-62.51	29.06	-5.37
LSD(0.05)	257.1		3.1	

In case of seed yield, the strain S-6695 out yielded all the contestants and gave seed yield of 2829Kg ha<sup>-1</sup>(44.71% higher than check) followed by the strain S-6692 (2675kg ha<sup>-1</sup>) as compared to check variety BR-2017 (1955kg ha<sup>-1</sup>). The first six strains gave 8.13% to 44.71% higher seed yield

than the check variety. As for as the fodder yield is concerned, strain S-6686 produced maximum fodder yield of 36.27  $\text{tha}^{-1}$  followed by S-6710 (35.37  $\text{tha}^{-1}$ ) than check variety i.e. BR-2017 (30.71  $\text{tha}^{-1}$ ). On the basis of good performance, six strains S-6682, S-6686, S-6683, S-6692, S-6695 and S-6710 were selected for further evaluation in C-trials during the year 2021. Statistical analysis revealed highly significant differences among the mean value

#### 5.1.1.7 Advance Guar Yield Trial (C-Trial)

An experiment comprising of 07 strains including one check was sown on 23.06.2020. 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 data were recorded for fodder yield during August, 2020 and for seed yield during November, 2020 which are given as under:

**Table: 7 Results of Advance Guar Yield Trial**

Strains	Seed yield (Kg $\text{ha}^{-1}$ )	$\pm$ % over check	Fodder Yield (t $\text{ha}^{-1}$ )	$\pm$ % over check
S-6642	2688	22.40	34.59	16.94
S-6666	2469	12.43	35.62	20.42
S-6668	2405	9.52	34.85	17.82
<b>BR-2017 (Check)</b>	<b>2196</b>	0.00	<b>29.58</b>	0.00
S-6636	2170	-1.18	25.33	-14.37
S-6669	1893	-13.80	21.99	-25.66
S-6637	1556	-29.14	30.89	4.43
LSD(0.05)	275.5		2.80	

The strain S-6642 produced maximum seed yield of 2688  $\text{Kg ha}^{-1}$  and out yielded all the contestants followed by the strain S-6666 (2469  $\text{Kg ha}^{-1}$ ) than check variety BR-2017 which produced 2196  $\text{Kg ha}^{-1}$ . As for as the fodder yield is concerned, strain S-6666 produced maximum yield of 35.62  $\text{tha}^{-1}$  followed by S-6668 (34.85  $\text{tha}^{-1}$ ) than check variety BR-2017 which gave 29.58  $\text{tha}^{-1}$ . The three strains S-6642, S-6666 and S-6668 produced 9.52-22.40% higher seed yield than check BR-2017 whereas the same strains S-6642, S-6666 and S-6668 produced 16.94-20.42% higher fodder yield than check variety. On the basis of good performance, these three strains were selected for further evaluation during the year 2021 in Zonal Varietal Trial. Statistical analysis revealed highly significant differences among the mean values.

#### 5.1.1.8 Zonal Guar Yield Trial

An experiment consisting of 05 strains including one check was sown at 3 locations at Govt. farms in Punjab i.e. Khanewal, Karor Lal Eson and Bahawalpur. The experiment was laid out according to RCBD having 4 repeats and plot size of 2.7m x 7.2m. The data were recorded for fodder yield during August, 2020 and for seed yield during November, 2020. 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-6547 out yielded all the contestants and gave higher seed yield of 2356Kg ha<sup>-1</sup> followed by S-6159 which gave 2268Kg ha<sup>-1</sup> as compared to check variety BR-2017 (1932 Kg ha<sup>-1</sup>) on the basis of 3 locations average. The maximum seed yield of 2837Kg ha<sup>-1</sup> was produced by S-6547 at ARS, Bahawalpur as compared to check (2310Kg ha<sup>-1</sup>). As for as the fodder yield is concerned, strain S-6547 produced maximum yield of 31.3 tha<sup>-1</sup> followed by S-6536 (30.0 tha<sup>-1</sup>) on the basis of average of three locations than check variety BR-2017 which gave 27.9 tha<sup>-1</sup>. The results revealed that three strains S-6747, 6159 & S-6536 performed better than the check variety.

**National Uniform Yield Trial Of Guar**

Seed of 02 strains S-6161 & S-6547 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. CRI, Khanpur
5. BARI, Chakwal

The guar strains were given code numbers by Coordinator (Fodder) and were sent to testing sites alongwith sowing plan. At the end of Kharif season, the decoded data on seed and fodder yield were received from the Coordinator (Fodder) which are presented as under:

**Table: 9 National Uniform Yield Trial of Guar**

The data on seed yield received from the Coordinator (Fodder) revealed that strain S-6161 developed by this station produced seed yield of 3108 Kg ha<sup>-1</sup> on the basis of average of five locations as compared to the check variety BR-2017 (2455 Kg ha<sup>-1</sup>) whereas strain S-6547 produced lower seed yield than check variety i.e. 2455 Kg ha<sup>-1</sup>. In case of fodder yield, the strain S-6161 produced maximum yield of 29.0 t ha<sup>-1</sup> on the basis of average of five locations than check variety BR-2017

Entry	Seed Yield (Kg ha <sup>-1</sup> )					
	BARS, FateJang	BARI, Chakwal	AZRI, BWP	AZRI, Bhakkar	CRI, RYK	Average
S-6161	2788	3628	3811	1391	3924	3108
<b>BR-2017 (Check)</b>	<b>1934</b>	<b>4363</b>	<b>2996</b>	<b>1109</b>	<b>3539</b>	<b>2788</b>
S-6547	1979	3968	2930	1016	2383	2455
LSD (0.05)	277.8	712.1	304.4	241.3	360.1	
	Fodder Yield (t ha <sup>-1</sup> )					
	BARS, FateJang	BARI, Chakwal	AZRI, BWP	AZRI, Bhakkar	CRI, RYK	Average
S-6161	25.31	34.88	35.19	12.89	36.63	29.0
<b>BR-2017(Check)</b>	<b>17.70</b>	<b>41.98</b>	<b>27.98</b>	<b>10.24</b>	<b>33.33</b>	<b>26.2</b>
S-6547	18.52	37.65	27.57	9.25	21.81	23.0
LSD (0.05)	2.71	6.97	3.10	2.34	3.65	

which gave 26.2 t ha<sup>-1</sup>. The results clearly reflect that the strain S-6161 performed better than the check variety.

#### Evaluation of advance lines of guar under drought stress conditions to address the climate change

An experiment consisting of 07 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 23.06.2020. 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. However, the rainfall was observed during the months of May (14mm), July (83mm) and August (123mm). The experiment was harvested during November, 2020 and seed yield data were recorded which are given as under:

**Table: 10 Results of Drought Stress Trial**

Entry Name	Seed Yield (Kg ha <sup>-1</sup> )
S-6536	1784
S-5823	1620
S-6384	1601
S-6547	1585
S-6159	1492
<b>BR-2017 (Check)</b>	<b>1483</b>
S-6543	1157
LSD(0.05)	279.0

Under drought stress conditions, the variety S-6536 out yielded all the contestants and gave the maximum seed yield of 1784Kg ha<sup>-1</sup> followed by the S-5823 (1620 Kg ha<sup>-1</sup>), S-6384 (1601 Kg ha<sup>-1</sup>), S-6547 (1585 Kg ha<sup>-1</sup>) and S-6159 (1492 Kg ha<sup>-1</sup>) as compared to check BR-217 which produced 1483Kg ha<sup>-1</sup>. It is concluded that strains S-6536, S-5823, S-6384, S-6547 and S-6159 can be better adapted to the drought stress conditions and can produce better seed yield. The mean values differed significantly from one another.

## **AGRONOMIC STUDIES**

### **Response of guar strains to nitrogen, phosphorus and potash fertilizers for seed yield**

An experiment comprising of a new guar strain S-6384 was laid out in RCBD with 3 repeats and plot size of 1.8m x 2.7m during Kharif, 2020 to find out the optimum dose of Nitrogen, Phosphorous and Potash fertilizers for new guar strain S-6384 in order to obtain maximum seed yield. The experiment was sown on 23.06.2020 and eight treatments of NPK fertilizers were applied as mentioned in the table below. The similar agronomic practices were adapted for all the treatments throughout growth period. The data on seed yield were recorded and are given as under:

**Table: 11 Results of NPK Fertilizer Trial of Guar**

Treatments N-P-K (Kg ha <sup>-1</sup> )	Guar Line S-6384 Seed Yield (Kg ha <sup>-1</sup> )
T1 (00-00-00)	1494
T2 (15-30-45)	1868
T3 (20-40-50)	2241
T4 (25-50-55)	2466
<b>T5 (30-60-60)</b>	<b>2886</b>
T6 (35-70-65)	2750
T7 (40-80-70)	2594
T8 (45-90-75)	1974
LSD (0.05)	331.44

The data revealed that the guar strain S-6384 produced maximum seed yield of 2886Kg ha<sup>-1</sup> at fertilizer dose of NPK30-60-60 Kg ha<sup>-1</sup> i.e. at T5. Further increase or decrease in fertilizer's doses

resulted in decrease of seed yield which revealed that optimum dose of NPK positively affected seed yield. Therefore, fertilizer treatment T5 i.e. NPK30:60:60 Kg ha<sup>-1</sup> is most suitable for getting maximum seed yield from guar strain S-6384 which also confirmed previous year's results. Furthermore, statistical analysis revealed significant differences among the mean values.

#### **Effect of different row spacing on the seed yield of new guar strains**

An experiment consisting of a guar strain S-6384 and a check (BR-2017) was laid out in Split Plot Design with 4 repeats and plot size of 1.8m x 2.7m during Kharif, 2020 to investigate the effect of 3 row spacings i.e. 30, 45 and 60 cm on seed yield of guar. The experiment was sown on 23.06.2020. The similar agronomic practices were adapted for all the varieties/treatments throughout growth period. The data on seed yield were recorded and are given as under:

**Table:12 Results of Row Spacing Trial of Guar**

Treatments	Row Spacing (cm)	varieties	
		BR-2017	S-6384
T1	30	2010	2262
<b>T2</b>	<b>45</b>	<b>2324</b>	<b>2695</b>
T3	60	1916	2488
LSD (0.05)	V=334.28	RS=135.17	RS*V=191.15

The data recorded illustrated that the crop planted on 45cm row spacing gave higher seed yield. The strain S-6384 produced maximum seed yield of 2695Kg ha<sup>-1</sup> and BR-2017 produced 2324Kg ha<sup>-1</sup> while further increase or decrease in row spacing i.e. 30cm & 60 cm resulted in decreased yield which also confirmed previous year's results. Statistical analysis revealed significant differences among the mean values.

#### **Effect Of Different Sowing Dates On The Seed Yield Of New Guar Strains**

An experiment consisting of a guar strain S-6384 and a check (BR-2017) was laid out in Split Plot Design with 3 repeats and plot size of 1.8m x 2.7m during Kharif, 2020 to find out the optimum sowing dates for new guar strain to harvest maximum seed yield. The experiment was sown at five different sowing dates i.e. 01/05, 15/05, 01/06, 15/06 & 01/07. The similar agronomic practices were adapted for all the varieties/treatments throughout growth period. The data on seed yield were recorded and are given as under:

Treatments	Varieties	
	BR-2017	S-6384
T1 (01/05)	2036	2293
<b>T 2 (15/05)</b>	<b>2415</b>	<b>2765</b>
<b>T 3 (01/06)</b>	<b>2380</b>	<b>2625</b>
T 4 (15/06)	2142	2334
T 5 (01/07)	1685	1893
LSD (0.05)	V=377.84 SD=244.57	V*SD=345.88

**Table: 13 Results of Sowing Date Trial of Guar**

The data revealed that both the varieties S-6384 and check BR-2017 produced maximum seed yield of 2765 Kg ha<sup>-1</sup> and 2415 Kg ha<sup>-1</sup>, respectively, at sowing date of 15<sup>th</sup> May followed by experiment sown at 1<sup>st</sup> June. Further increase or decrease in sowing dates resulted in decrease of seed yield. Statistical analysis revealed significant differences among the mean values.

**Effect Of Sowing Methods On Seed Yield Of Guar Under Irrigated Conditions Of Bahawalpur**

An experiment comprising of a guar variety (BR-2017) was laid out in RCBD with 3 repeats and plot size of 1.8m x 2.7m during Kharif, 2020 to find out appropriate sowing method in guar crop for achieving maximum seed yield of guar under climate change scenario. The experiment was sown on 23.06.2020 by using four different sowing methods i.e. drill sowing, bed planting, broadcast & ridge sowing. The similar agronomic practices were adapted for all the treatments throughout growth period. The data on seed yield were recorded and are given as under:

**Table: 14 Results of Sowing Method Trial of Guar**

Treatments/ Sowing Method	Seed Yield (Kg ha <sup>-1</sup> )
T1 Drill	2317
<b>T2 Bed</b>	<b>2556</b>
T3 Broadcast	1724
T4 Ridge	2146
LSD (0.05)	368.46

The data revealed that guar variety BR-2017 produced maximum seed yield (2556 Kg ha<sup>-1</sup>) on bed planting followed by drill sowing (2317 Kg ha<sup>-1</sup>). Therefore, the bed planting and drill sowing are the best sowing methods to obtain optimum seed yield of guar crop. Statistical analysis revealed significant differences among the mean values.

### **Response Of Various Fungicides And Their Time Of Application To Control Fungal Diseases Of Guar Under Changing Climate**

An experiment comprising of a guar variety (BR-2017) was laid out in RCBD with 3 repeats and plot size of 1.8m x 2.7m during Kharif, 2020 to find out appropriate fungicides and their time of application for control of fungal diseases (Fusarium wilt, bacterial blight, alternaria leaf spot, root rot) in guar crop for maximum seed yield of guar under varying climatic conditions. The experiment was sown on 23.06.2020 and thirteen treatments were applied as per plan given below in table 15. After starting application each fungicide was applied 3 times with 10 days' interval. The data recorded on seed yield and wilting %age are given as under:

**Table: 15 Results of Sowing Method Trial of Guar**

Treatments/Fungicides	Time of application	Seed Yield (Kg ha <sup>-1</sup> )	Wilting %age
T1 Control (No Fungicide)	-	1778	8.0
T2 Dithane-M @600 g/100 Lit	25 DAS	<b>2435</b>	1.5
T3 Protocol @450 g/100 lit	25 DAS	2015	2.0
T4 Topsin-M @ 150 g/100 Lit	25 DAS	2453	3.0
T5 Redomil Gold @250g/100 Lit	25 DAS	2075	4.5
<b>T6 Dithane-M @600 g/100 Lit</b>	<b>35 DAS</b>	<b>2545</b>	<b>0.8</b>
T7 Protocol @450 g/100 lit	35 DAS	2100	1.5
T8 Topsin-M @ 150 g/100 Lit	35 DAS	2493	3.5
T9 Redomil Gold @250g/100 Lit	35 DAS	2313	3.5
T10 Dithane-M @600 g/100 Lit	45 DAS	<b>2367</b>	2.5
T11 Protocol @450 g/100 lit	45 DAS	1922	3.0
T12 Topsin-M @ 150 g/100 Lit	45 DAS	2215	4.0
T13 Redomil Gold @250g/100 Lit	45 DAS	2068	5.0
LSD (0.05)	DAS=99	Fungi=121	DAS*Fungi=209

The results revealed that Fungicide Dithane-M @600g/100 L performed better than all other fungicides as 1.5 %, 0.8% & 2.5% plant's wilting was observed when applied on 25 DAS, 35 DAS & 45 DAS respectively as compared to control (8.0% wilting) where no fungicide was applied. Furthermore, the fungicide Topsin-M also provided good results when applied @ 150 g/100 Lit on 25 DAS, 35 DAS & 45 DAS as 3.0 %, 3.5% & 4.0% plant's wilting was observed respectively. Maximum seed yield (2545 kg ha<sup>-1</sup>) was obtained in T6 when Dithane-M @600 g/100 Lit was applied on 35 DAS. On the other hand, fungicide Redomil Gold showed maximum plant's wilting 4.5 %, 3.5% & 5.0% when applied @250g/100 Lit on 25 DAS, 35 DAS & 45 DAS respectively. It is concluded that fungicide Dithane-M @600g/100 L should be applied on 35 DAS to obtain maximum yield.

## **ENTOMOLOGICAL STUDIES**

### **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, 2020 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 data on insect pest recorded by the Entomologist, RARI, Bahawalpur are given as under:

**Table:16 Response of Guar Genotypes to Insect Pests**

Entries	Average Jassid/Leaf	Average W.F./Leaf
S-6159	0.44	3.86
S-6543	0.62	4.00
S-6536	0.55	4.56
S-6547	0.77	4.69
BR-2017 (Check)	0.82	4.80
LSD 5%	0.42	1.80
<b>Entries</b>	<b>Bacterial blight and Alternaria blight</b> were observed and plant reaction was as under	
	<b>Bacterial blight</b>	<b>Alternaria blight</b>
S-6169	Resistant	Moderately Resistant
S-6543	Moderately Susceptible	Susceptible
S-6536	Moderately Resistant	Moderately Resistant
S-6547	Moderately Resistant	Resistant
BR-2017 (Check)	Moderately Resistant	Moderately Resistant

The data received from the Entomologist revealed that only attack of white fly and jassid was observed. The strain S-6159 had minimum attack of jassid ( $0.44 \text{ leaf}^{-1}$ ) followed by S-6536 ( $0.55 \text{ leaf}^{-1}$ ) whereas BR-2017 had the highest infestation of jassid ( $0.82 \text{ leaf}^{-1}$ ). However, the attack was below ETL on all strains. In case of white fly, again the strain S-6159 had minimum infestation of whitefly ( $3.86 \text{ leaf}^{-1}$ ) followed by the strain S-6543 ( $4.00 \text{ leaf}^{-1}$ ) while BR-2017 had maximum attack of white fly ( $4.80 \text{ leaf}^{-1}$ ). The data shows better performance of all the strains against insect pest as attack is below ETL on all entries. The statistical analysis of the data revealed highly significant differences among the guar strains.

## **PATHOLOGICAL STUDIES**

### **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, 2020 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:17 Results of Screening of Guar Genotypes against Diseases**

The Plant Pathologist, RARI, Bahawalpur reported that incidence of bacterial blight and alternaria blight was observed under Bahawalpur conditions. The results showed that S-6161 was resistant to bacterial blight and S-6536, S-6547 and BR-2017 were moderately resistant whereas S-6543 was moderately susceptible to this disease. In case of alternaria blight, the strain S-6547 was found

resistant while all other strains including check were moderately resistant except S-6543 which was found susceptible.

### **PEARL MILLET (*Pennisetum glaucum* L.)**

#### **Adaptability Green Fodder Yield Trial On Pearl Millet**

This trial was received from the Chief Scientist, Fodder Research Institute, Sargodha during Kharif, 2020. 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 was consisted of 09 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 24.08.2020. The data on fodder yield were recorded at the time of 50% flowering. The data recorded on green fodder yield are given as under:

<b>Entry</b>	<b>Green Fodder Yield(t ha<sup>-1</sup>)</b>
High Group	72.1
N-5	68.5
DBR-3	70.1
Composite-4	77.9
EXBD2 Bulk	78.1
Sgd-Bajra-2011 (Check)	68.1
<b>FB-791</b>	<b>79.5</b>
FB-809	79.1
FB-810	76.1

**Table:18 Results of Adaptability Trial of Pearl Millet**

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

### **MAIZE (*Zea mays* L.)**

#### **Adaptability Green Fodder Yield Trial Of Maize**

This trial was received from the Chief Scientist, 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 24.08.2020. The data recorded on green fodder yield at the time of 50% flowering are given as under:

**Table:19 Results of Adaptability Green Fodder Yield Trial of Maize**

<b>Entry</b>	<b>Green Fodder Yield (t ha<sup>-1</sup>)</b>
MS-05-2018	31.55
MS-06-2018	38.55
MS-04-2018	41.14
<b>FD-2019</b>	<b>42.17</b>
Composite	36.56
Sgd.-2002 (Check)	37.22

Super Green Maize (Check)	33.09
LSD (0.05)	9.88

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

### **SORGHUM (*Sorghum bicolor* L.)**

#### **Adaptability Green Fodder Yield Trial Of Sorghum**

An experiment consisting of 08 coded strains of sorghum was received from the Chief Scientist, 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 24.08.2020. The data recorded on green fodder yield at the time of 50% flowering are given as under:

**Table:20 Results of Adaptability Trial of Sorghum**

<b>Entry</b>	<b>Green Fodder Yield (t ha<sup>-1</sup>)</b>
<b>F-02-2018</b>	<b>83.25</b>
SD-167	70.90
YSS-89	57.86
JABAL	68.69
YSS-15	42.18
NO.6197	63.84
F-01-2018	79.89
JS-2011 (Check)	51.14
LSD (0.05)	7.26

The data were sent to the Chief Scientist, Fodder Research Institute, Sargodha

### **OATS(*Avena sativa* L.)**

#### **Hybridization Of Oats and Study Of Filial Generations**

To combat biotic (insect pests/ diseases), abiotic stresses (drought) and to create genetic variability and selection of desirable recombinants from different generation of oats, hybridization programme was undertaken by crossing different oats genotypes. The following 10 fresh crosses were attempted:

**Table 21: Hybridization of Oats**

<b>Cross #</b>	<b>Name of Cross</b>	<b>No. of spikes crossed</b>	<b>No. of successful Spikes</b>
1.	FRI-2003 X SGD-2001	80	1
2.	FRI-2003 X S-2000	90	1
3.	FRI-2003 X No. 668	120	7
4.	FRI-2003 X FRI-2002	95	1
5.	SGD-2001 X FRI-2003	75	-
6.	SGD-2001 X No. 668	100	1
7.	SGD-2001 X FRI-2002	90	1
8.	S-2000 X No. 668	70	-
9.	S-2000 X FRI-2002	90	2

10.	No. 668 X FRI-2002	100	3
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F<sub>0</sub> seed was harvested for growing F<sub>1</sub> during Rabi, 2021-22.

Furthermore, following generations were/. maintained during Rabi, 2020-21

Generation	Parental Crosses/progenies studied	Crosses/plants/ progenies selected
F <sub>1</sub>	4 (Crosses)	4 (Crosses)

### Adaptability Green Fodder Yield Trial Of Oats

This trial was received from the Chief Scientist, Fodder Research Institute, Sargodha during Rabi, 2020-21. 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 4m and was sown on 01.12.2020. The data on green fodder yield were recorded at the time of 50% flowering and are given as under:

**Table:22 Results of Adaptability Green Fodder Yield Trial of Oats**

Varieties	Green Fodder Yield (t ha <sup>-1</sup> )
P1	61.1
P2	67.8
P3	71.4
P4	63.1
P5	67.8
P6	68.8
P7	65.8
<b>P8</b>	<b>71.8</b>
P9	66.4
P10	66.8
LSD (0.05)	4.88

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

### Advance Green Fodder Yield Trial Of Oats

This trial was received from the Chief Scientist, Fodder Research Institute, Sargodha during Rabi, 2020-21. 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 4m and was sown on 01.12.2020. The data on green fodder yield were recorded at the time of 50% flowering and are given as under:

**Table:23 Results of Advance Green Fodder Yield Trial of Oats**

Varieties	Green Fodder Yield (t ha <sup>-1</sup> )
P1	67.1
P2	71.4
P3	68.8
P4	65.4
<b>P5</b>	<b>82.1</b>
P6	80.4
P7	82.0

P8	77.7
P9	64.8
P10	69.8
LSD (0.05)	6.68

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

### **BERSEEM(*Trifoliumalexandrinum*L.)**

#### **Adaptability Green Fodder Yield Trial On Berseem**

This trial was received from the Chief Scientist, Fodder Research Institute, Sargodha. The trial consisted of 08 coded entries (A-H) of Berseem and was laid out according to RCBD with 3 replications and plot size of 3m x 5m. The experiment was sown on 13.11.2020. The data on fodder yield were recorded and each entry was harvested for four times. The compiled data are given as under:

**Table: 24 Results of Adaptability Fodder Yield Trial on Berseem**

Varieties	Green Fodder Yield (t ha <sup>-1</sup> )
A	87.0
B	91.4
C	92.8
D	95.0
E	100.5
F	97.4
<b>G</b>	<b>103.6</b>
H	101.6
<b>LSD (0.05)</b>	

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



5.6.2

**Figure 05: adaptability trial on berseem (2020-21)**

#### **National Uniform Fodder Yield Trial On berseem**

An experiment consisting of ten entries (1-10) 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 13.11.2020. The data on fodder yield were recorded and each entry was harvested for four times. The compiled data are given as under:

**Table:25 Results of National Uniform Fodder Yield Trial on Berseem**

Entries No.	Fodder Yield (t ha <sup>-1</sup> )
1	89.3
2	88.3
3	85.2
4	74.0
5	83.5
6	82.6
7	87.9
<b>8</b>	<b>90.5</b>
9	82.1
10	78.1

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



**Figure 06: NUYT on Berseem (2020-21)**

### **Effect of number of cuttings on the seed production of Berseem under climatic conditions of Bahawalpur.**

An experiment comprising of a Berseem variety (Berseem Agaitti) was laid out according to RCBD with 3 replications and plot size of 3m x 6m to find out optimum number of cuttings to obtain higher seed production of Berseem under climatic conditions of Bahawalpur. The experiment was sown on 25.11.2020 and five treatments were applied as given in table 24. The data recorded on seed yield is given as under:

**Table: 26 Effect of number of cuttings on the seed production of Berseem**

Treatments	Seed Yield (Kg ha <sup>-1</sup> )
T1 (No cut)	302

T2 (single cut)	380
<b>T3 (two cuts)</b>	<b>522</b>
T4 (three cuts)	431
T5 (four cuts)	342
LSD (0.05)	0.60

The data showed that maximum seed yield of 522Kg ha<sup>-1</sup> was obtained on two cutting (T3) of the crop followed by seed yield (431Kg ha<sup>-1</sup>) on three cutting (T4) as compared to seed yield (302 Kg ha<sup>-1</sup>) on control (T1) where no cutting was done. Further increase or decrease in number of cutting was resulted in decrease of seed yield of Berseem. Therefore, it is most suitable that crop should be retained for seed purpose after two cuttings of fodder to get maximum seed yield.

### Phosphorous and Potassium Requirement Of Berseem For Seed Production

An experiment comprising of a Berseem variety (Berseem Agaitti) was laid out according to RCBD with 3 replications and plot size of 3m x 6m to find out optimum dose of phosphorous and potassium for higher seed production of Berseem under climatic conditions of Bahawalpur. The experiment was sown on 13.11.2020 and twelve treatments were applied as given in table 24. The data recorded on seed yield is given as under:

**Table: 27 Results of phosphorous and potassium requirement of Berseem**

Treatments	P <sub>2</sub> O <sub>5</sub> (Kg ha <sup>-1</sup> )	K <sub>2</sub> O (Kg ha <sup>-1</sup> )	Seed Yield (Kg ha <sup>-1</sup> )
T1	40	0	300
T 2	60	0	345
T 3	80	0	361
T 4	40	15	403
T 5	60	15	420
T6	80	15	458
T7	40	30	559
<b>T8</b>	<b>60</b>	<b>30</b>	<b>656</b>
T9	80	30	501
T10	40	45	380
T11	60	45	383
T12	80	45	363
LSD (0.05)			64.29

The data revealed that Berseem crop produced maximum seed yield of 656Kg ha<sup>-1</sup> at fertilizer dose (T8) of P.K.60-30 Kg ha<sup>-1</sup> followed by seed yield (559Kg ha<sup>-1</sup>) at fertilizer dose (T7) of P.K.40-30 Kg ha<sup>-1</sup>. Further increase or decrease in fertilizer's doses resulted in decrease of seed yield which revealed that optimum dose of phosphorous and potash positively affected seed yield. Therefore, fertilizer treatment T8 i.e. PK60:30 Kg ha<sup>-1</sup> is most suitable for getting maximum seed yield from Berseem crop.



**Figure 07: Phosphorous and potassium requirement of Berseem**

### **LUCERNE(*Medicago sativa* L.)**

#### **National Uniform Fodder Yield Trial On Lucerne**

An experiment consisting of 07 entries 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 4m and was sown on 13.11.2020. The data on fodder yield were recorded. The data on fodder yield were recorded and each entry was harvested for four times. The compiled data are given as under:

**Table:28 National Uniform Fodder Yield Trial on Lucerne**

<b>Varieties</b>	<b>Fodder Yield (t ha<sup>-1</sup>)</b>
1	52.3
2	43.1
3	47.9
4	42.5
5	42.7
6	62.0
<b>7</b>	<b>68.1</b>

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

### **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 2020-21, the following quantity of seed was produced:

**Table:29 Seed production of different fodder crops**



<b><i>Crop</i></b>	<b><i>Variety</i></b>	<b><i>BNS (kg)</i></b>	<b><i>Pre-basic (kg)</i></b>	<b><i>Total</i></b>
<b><i>Guar</i></b>	<b><i>BR-2017</i></b>	<b><i>40</i></b>	<b><i>1150</i></b>	<b><i>1190</i></b>
<b><i>Sorghum</i></b>	<b><i>Sorghum-2011</i></b>	<b><i>-</i></b>	<b><i>1400</i></b>	<b><i>1400</i></b>
<b><i>Berseem</i></b>	<b><i>Berseem Agaitti</i></b>	<b><i>-</i></b>	<b><i>1100</i></b>	<b><i>1100</i></b>
	<b><i>Punjab Berseem</i></b>	<b><i>-</i></b>	<b><i>800</i></b>	<b><i>800</i></b>
<b><i>Lucerne</i></b>	<b><i>Sargodha Lucerne</i></b>	<b><i>-</i></b>	<b><i>900</i></b>	<b><i>900</i></b>
<b><i>Oat</i></b>	<b><i>Sgd. Oats-2011</i></b>	<b><i>-</i></b>	<b><i>3600</i></b>	<b><i>3600</i></b>