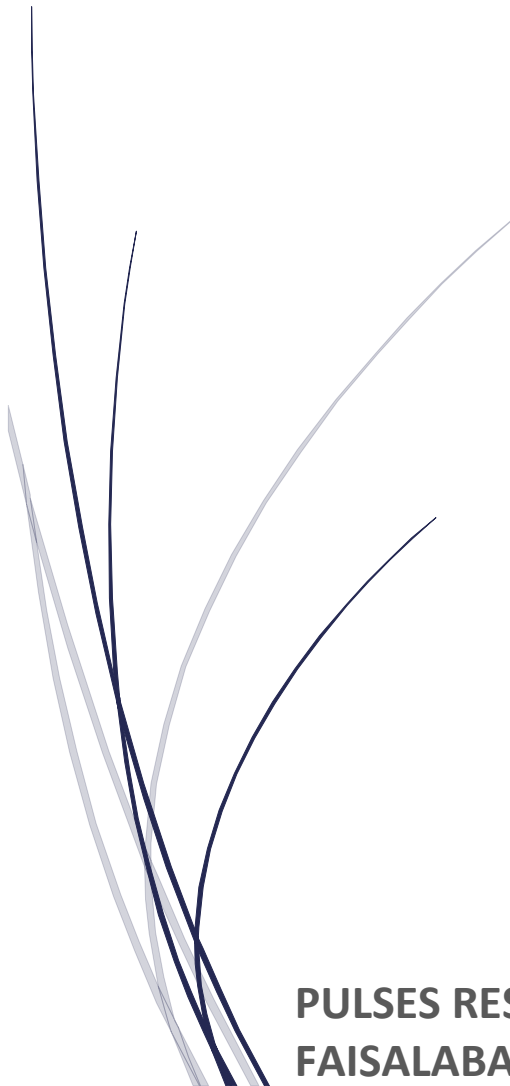




**Kharif
2019**

Annual Program of Research Work



**PULSES RESEARCH INSTITUTE,
FAISALABAD.**

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INTRODUCTION

Mung (*Vigna radiata* L. Wilczek) and Mash (*Vigna mungo* L. Hepper) are the two most important pulse crops grown in kharif season in Pakistan. Mung bean leads in acreage and production among Kharif pulses. In national scenario mung bean production, during last five years Punjab leads with 90% contribution. Leading mung bean producing districts are Bhakkar, Layyah and Mianwali. In Punjab during last five-year acreage increased from 113.1 to 163.7 thousand hectare. However, during 2017-18 in Punjab its acreage was 148.3 thousand hectares as compared to 163.7 thousand hectars during 2016-17. Similarly, its production decreased from 120.9 to 113.2 thousand tonnes during 2017-18 over last year.

Pakistan is deficient in mash bean production to meet the domestic demands. Pakistan need to import mash bean to meet its requirements. Punjab contributed 49% of total production of the country during 2017-18 followed by Baluchistan with 40% share. Leading mash bean producing districts are Narowal, Rawalpindi and Sialkot. But the area is continuously decreasing. The area under mash has declined from 16.1 thousand hectares during 2013-14 to 11.1 thousand hectare during 2017-18. Similarly, mash production has decreased from 6.0 thousand tonnes in 2013-14 to 3.5 thousand tonnes in 2017-18. This shows a dire need to boost research activities to increase area and production of this crop. Cowpea is also gaining popularity among consumer/farmers due to its multifarious uses. However, its production in the country is very limited.

Pulses Research Institute has intensified its efforts to increase domestic production of mung, mash and cowpeas with introduction of high yielding and disease resistant genotypes coupled with climate resilient production technology.

Significant Achievements of Last Year`s Research: -

Mung bean

- The institute has developed four early maturing advance lines taking only 60 days to mature. These lines are PML-15002, PML-15003, PML-15024 and PML-15039
- Advance line PML 16051 found resistant against *Cercospora* leaf spot disease. While seventeen entries were found moderately resistant.
- Twenty crosses were attempted and Eighteen were successfully harvested.
- In advance yield trial six entries surpassed the check variety. Maximum yield was produced by PML-16005 (1230 kg/ha) followed by PML-16002(1086 kg/ha)
- In Micro yield trial Six entries yielded higher (1210-1028 kg/ha) as compared to check AZRI-2006 (966 kg/ha). Maximum yield was produced by V-15002 (1210 kg/ha) followed by PML -15005 (1186 kg/ha)
- 2325 kg pre-basic and 2710 kg basic seed was produced by this institute.

Mash bean

- The institute has enriched its germplasm of three hundred and three entries including 160 genotypes from USA.
- 25 cross combinations were attempted and 21 crosses were successfully harvested.
- Spring sown advance lines gave much higher yield than Kharif trails. Entry 17M011 (2835kg/ha), 16M006 (2623 kg/ha) out yielded Check Variety Arooj 2011 (2612kg/ha) in Spring sown Preliminary and micro yield trials.
- Twelve line showed resistant against Mashbean bean Yellow Mosaic Virus (MYMV) while twenty lines were

found resistant against ULCV.

- 2291 kg pre-basic/basic seed was produced by this institute.

Pulses Research Institute is striving hard to cope with increasing challenges with the following strategies.

- Broadening of genetic base of Mung and Mash crop through strengthening of germplasm.
- Development of high input responsive cultivars possessing high yield potential, wider adaptability, short duration, resistant to insect pests and diseases.
- Seed multiplication of improved varieties and its distribution to farmers/seed companies
- Dissemination of improved production technology among the growers.
- Popularization of spring sowing of Mung and Mash.
- Popularization of intercropping of Mung and Mash in spring planted sugarcane.
- Popularization of Mung as catch crop in rice wheat system.

A- MUNGBEAN (*Vigna radiata* L. Wilczek) 2n = 22

1- Title Maintenance of Germplasm

| | | | | | | | | | | | | | | | | | | | |
|------------------------------------|--|----------------|------------------|--------|-----|---------------|------|-------|--------------|--------|-------------|-----------|--------------|---------------|---------|---------------|--------------------------|------------------|--|
| Objectives | <ol style="list-style-type: none"> 1. To maintain the genetic purity 2. To enrich the germplasm 3. To identify the sources for different economic characters. | | | | | | | | | | | | | | | | | | |
| Research worker(s) | Muhammad Sajjad Saeed, Sadia Kaukab, Dr. Busharat Hussain & Ch. Muhammad Rafiq | | | | | | | | | | | | | | | | | | |
| Project duration | 2019 (continuous) | | | | | | | | | | | | | | | | | | |
| Location | Faisalabad | | | | | | | | | | | | | | | | | | |
| Treatments/ Methodology | <table border="0"> <tr> <td>No. of Entries</td> <td>= 310 + 40 = 350</td> </tr> <tr> <td>Blocks</td> <td>= 5</td> </tr> <tr> <td>Entry / block</td> <td>= 70</td> </tr> <tr> <td>Check</td> <td>= PRI M-2018</td> </tr> <tr> <td>Design</td> <td>= Augmented</td> </tr> <tr> <td>Plot size</td> <td>= 4m x 0.30m</td> </tr> <tr> <td>Plant spacing</td> <td>= 10 cm</td> </tr> <tr> <td>Planting date</td> <td>= 2nd fortnight of June.</td> </tr> <tr> <td>Data to be taken</td> <td>= Days to 50 % flowering, days to 90% maturity, plant height, Number of pods/plant, pod length, Number of seeds/pod, 1000 grain weight, seed yield and incidence of diseases under natural conditions.</td> </tr> </table> | No. of Entries | = 310 + 40 = 350 | Blocks | = 5 | Entry / block | = 70 | Check | = PRI M-2018 | Design | = Augmented | Plot size | = 4m x 0.30m | Plant spacing | = 10 cm | Planting date | = 2nd fortnight of June. | Data to be taken | = Days to 50 % flowering, days to 90% maturity, plant height, Number of pods/plant, pod length, Number of seeds/pod, 1000 grain weight, seed yield and incidence of diseases under natural conditions. |
| No. of Entries | = 310 + 40 = 350 | | | | | | | | | | | | | | | | | | |
| Blocks | = 5 | | | | | | | | | | | | | | | | | | |
| Entry / block | = 70 | | | | | | | | | | | | | | | | | | |
| Check | = PRI M-2018 | | | | | | | | | | | | | | | | | | |
| Design | = Augmented | | | | | | | | | | | | | | | | | | |
| Plot size | = 4m x 0.30m | | | | | | | | | | | | | | | | | | |
| Plant spacing | = 10 cm | | | | | | | | | | | | | | | | | | |
| Planting date | = 2nd fortnight of June. | | | | | | | | | | | | | | | | | | |
| Data to be taken | = Days to 50 % flowering, days to 90% maturity, plant height, Number of pods/plant, pod length, Number of seeds/pod, 1000 grain weight, seed yield and incidence of diseases under natural conditions. | | | | | | | | | | | | | | | | | | |
| Previous year's Results | Data was collected and maintained. The range of various characters recorded is as follows: | | | | | | | | | | | | | | | | | | |

| Characters | Range |
|-----------------------|--------|
| Days to 50% flowering | 28-50 |
| Plant height (cm) | 34-100 |
| Pod length (cm) | 5-18 |
| No. of grains/pod | 4-12 |
| No. of pods per plant | 20-82 |
| days to 90% maturity | 56-88 |
| 1000 grain weight (m) | 35-52 |

2- Title Hybridization Programme

Objectives To develop new recombinants of High yield potential

1. Wider adaptability
2. Early maturity
3. Resistance/tolerance to diseases
4. Bold seeded.

Research worker(s) Muhammad Sajjad Saeed, Sadia Kaukab, Dr. Busharat Hussain & Ch. Muhammad Rafiq

Project duration 2019 (continuous)

Location Faisalabad

**Treatments/
Methodology**

| Cross Combinations = 20 | | | | | | | |
|---|-------------------|---|-----------|-------|-------------------|---|-----------|
| Mung Bean New Cross Combination Kharif 2019 | | | | | | | |
| Sr. # | Cross Combination | | | Sr. # | Cross Combination | | |
| 1 | MPP-15024 | x | LS-442 | 11 | PML-13006 | x | LS-442 |
| 2 | " | x | MPP-15002 | 12 | " | x | MPP-15002 |
| 3 | " | x | MPP-15003 | 13 | " | x | MPP-15003 |
| 4 | " | x | MPP-15039 | 14 | " | x | MPP-15039 |
| 5 | " | x | PML-17004 | 15 | " | x | PML-17004 |
| 6 | NM-11 | x | LS-442 | 16 | PRI M-2018 | x | LS-442 |
| 7 | " | x | MPP-15002 | 17 | " | x | MPP-15002 |
| 8 | " | x | MPP-15003 | 18 | " | x | MPP-15003 |
| 9 | " | x | MPP-15039 | 19 | " | x | MPP-15039 |
| 10 | " | x | PML-17004 | 20 | " | x | PML-17004 |

| Sr. # | Variety/Line | Salient Characters |
|-------|--------------|------------------------------------|
| 1 | MPP-15024 | Early Maturing/disease tolerant |
| 2 | NM-11 | High yielding/disease tolerant |
| 3 | PML-13006 | Bold Seeded |
| 4 | PRI MUNG-18 | Drought tolerant |
| 5 | LS-442 | Extra-long pod |
| 6 | MPP-15002 | Short duration/early maturing |
| 7 | MPP-15003 | Short Duration/disease tolerant |
| 8 | MPP-15039 | MYMV Resistant/Early maturing |
| 9 | PML-17004 | Top bearing fruit/Erect type plant |

Date of Sowing = 2nd fortnight of June

Planting pattern = Parential lines will be planted in paired (male and female) 4 meter long and 60 cm apart rows to facilitate crossing

Previous year's Results 20 cross combinations were attempted and 18 successful crosses were harvested for further studies.

3- Title **Study of Filial Generations**

| | |
|---------------------------|--|
| Objectives | To select the desirable recombinants from segregating generations |
| Research worker(s) | Muhammad Sajjad Saeed, Sadia Kaukab, Dr. Busharat Hussain, Muhammad Aqeel & Ch. Muhammad Rafiq |
| Project duration | 2019 (continuous) |
| Location | Faisalabad |

Treatments/ Methodology

| Filial generations | Crosses/progenies selected/harvested |
|--------------------|--------------------------------------|
| F ₁ | 18 |
| F ₂ | 20 |
| F ₃ | 14/46 |
| F ₄ | 06/35 |
| F ₅ | 12/42 |
| F ₆ | 14/30 |

Row length = 4.0 m
 Row spacing = 30 cm
 Plant spacing = 10 cm
 Date of sowing = 2nd fortnight of June.

Previous year's Results

| Filial generations | Crosses/progenies studied | Crosses/progenies selected/harvested |
|--------------------|---------------------------|--------------------------------------|
| F ₀ | 20 | 18 |
| F ₁ | 32 | 20 |
| F ₂ | 28 | 14/46 |
| F ₃ | 7 | 6/35 |
| F ₄ | 15 | 12/42 |
| F ₅ | 26 | 14/30 |
| F ₆ | 14 | 10/26 |

4- Title **Preliminary Yield Trial**

| | |
|---------------------------|--|
| Objectives | To identify the promising genotypes for yield and other desirable characters |
| Research worker(s) | Muhammad Sajjad Saeed, Dr. Busharat Hussain, Sadia Kaukab, Ch. Muhammad Rafiq, Mushtaq Ahmad & Tariq Mahmood |
| Project duration | 2019 (continuous) |
| Location | Faisalabad & Kallur kot |

| | | |
|------------------------------------|---------------------|---|
| Treatments/ Methodology | Entries | = 10 viz; PM-18001, PML-18002, PML-18003, PM-18004, PML-18005, PML-18006, PML-18007, PML-18008, PML-18009 & PML-18010. |
| | Standards | = PRI MUNG-2018 & NM-2016 |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 4m x 1.2m |
| | Row spacing | = 30cm |
| | Plant spacing | = 10 cm |
| | Planting date | = 1st& 2 nd fortnight of June. |
| | Data to be recorded | = Plant Stand, Days to 50 % flowering, days to 90 % maturity, plant height, number of pods/plant, pod length, number of seeds/pod, 1000 grain weight, seed yield and disease incidence. |

**Previous year's
Results**

| S. # | Entries | Yield (kg/ha) |
|------|--------------------|---------------|
| 1 | 17004 | 1354 |
| 2 | 17003 | 1263 |
| 3 | 17006 | 1233 |
| 4 | 17008 | 1104 |
| 5 | 17007 | 1036 |
| 6 | 17005 | 986 |
| 7 | Azri-06 | 826 |
| 8 | 17001 | 816 |
| 9 | NM-16 | 796 |
| 10 | 17002 | 780 |
| | <i>L.S.D at 5%</i> | <i>19.12</i> |
| | <i>C.V %</i> | <i>11.55</i> |

5- Title Advance Yield Trial

| | |
|---------------------------|---|
| Objectives | To evaluate the high yielding and disease resistant genotypes. |
| Research worker(s) | Muhammad Sajjad Saeed, Dr. Busharat Hussain, Sadia Kaukab, Ch. Muhammad Rafiq, Mushtaq Ahmad & Tariq Mahmood. |
| Project duration | 2019 (continuous) |
| Location | Faisalabad and Kalurkot. |

| | | |
|------------------------------------|---------------------|---|
| Treatments/ Methodology | Entries | = 8 viz; PML-17001, PML-17002, PML-17003, PML-17004, PML -17005, PML-17006, PML -17007 & PML - 17008. |
| | Standards | = PRI MUNG-2018 & NM-2016 |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 4m x 1.2m |
| | Row spacing | = 30cm |
| | Plant spacing | = 10 cm |
| | Planting date | = 1st& 2 nd fortnight of June. |
| | Data to be recorded | = Plant Stand, Days to 50 % flowering, days to 90 % maturity, plant height, number of pods/plant, pod length, number of seeds/pod, 1000 grain weight, seed yield and disease incidence. |

Previous year's Results

| S. # | Entries | Yield (kg/ha) |
|------|--------------------|---------------|
| 1. | 16005 | 1230 |
| 2. | 16002 | 1086 |
| 3. | 16006 | 866 |
| 4. | 16004 | 842 |
| 5. | 16003 | 834 |
| 6. | 16001 | 796 |
| 7. | AZRI M-2006 | 752 |
| 8. | 16007 | 718 |
| 9. | NM-16 | 694 |
| | <i>L.S.D at 5%</i> | 24.55 |
| | <i>C.V %</i> | 15.14 |

6- Title **Micro Yield Trial**

| | |
|---------------------------|---|
| Objectives | To evaluate advance lines for high yield potential and wider adaptability under different ecological/agro climatic zones of the Punjab. |
| Research worker(s) | Muhammad Sajjad Saeed, Dr. Busharat Hussain, Sadia Kaukab, Muhammad Aqeel, Ch. Muhammad Rafiq, Mushtaq Ahmad & Tariq Mahmood. |
| Project duration | 2019 (continuous) |
| Location | Faisalabad, Karore, Kallurkot& Bahawalpur |

| | | |
|------------------------------------|---------------------|---|
| Treatments/ Methodology | Entries | = 7viz; PML -16001, PML -16002, PML - 16003, PML-16004, PML -16005, PML-16006 & PML-16007. |
| | Checks | = PRI MUNG-2018 & NM-2016. |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 4m x 1.2m |
| | Row spacing | = 30cm |
| | Plant spacing | = 10 cm |
| | Planting date | = 1st& 2 nd fortnight of June. |
| | Data to be recorded | = Plant Stand, Days to 50 % flowering, days to 90 % maturity, plant height, number of pods/plant, pod length, number of seeds/pod, 1000 grain weight, seed yield and disease incidence. |

Previous year's Results

| S. # | Entries | Yield (kg/ha) |
|------|--------------------|---------------|
| 1. | 15002 | 1210 |
| 2. | 15005 | 1186 |
| 3. | 15001 | 1138 |
| 4. | 15007 | 1098 |
| 5. | 15004 | 1036 |
| 6. | 15003 | 1028 |
| 7. | AZRI M-2006 | 966 |
| 8. | 15006 | 914 |
| 9. | NM-16 | 904 |
| | <i>L.S.D at 5%</i> | 19.71 |
| | <i>C.V %</i> | 10.61 |

7- Title **National Uniform Yield Trial**

| | |
|---------------------------|--|
| Objectives | To test the performance of candidate Mungbean cultivars of different institutes. |
| Research worker(s) | Muhammad Sajjad Saeed, Dr. Busharat Hussain, Sadia Kaukab & Ch. Muhammad Rafiq. |
| Project duration | 2019 (continuous) |
| Location | Faisalabad |

**Treatments/
Methodology**

This Institute will contribute 4 entries viz;
PML-14005, PML-15003, MPP-15002 & MPP-15039.

- Layout = As per instructions from the National Coordinator,
Pulses, NARC, Islamabad.
- Sowing date = 2nd fortnight of June
- Data to be recorded = Days to 50 % Flowering, days to 90% Maturity, Plant
height, Number of pods/plant, Pod length,
Number of seeds/pod, 1000 grain weight, seed
yield and disease incidence

**Consolidated Results of
Mung bean National Uniform Yield Trial 2018 across the country**

| Entry No. | Entry Name | Source | Locations* | | | | | | | | | Mean |
|----------------|----------------|-----------------|------------|-----|-----|------|------|-----|------|-----|-----|------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 1 | MH-13091 | NIAB, Fsd | 403 | 979 | 660 | 1858 | 1074 | 608 | 1715 | 503 | 741 | 949 |
| 2 | TM-1627 | AZRI, Bhakkar | 492 | 938 | 639 | 1965 | 1182 | 660 | 1287 | 514 | 704 | 931 |
| 3 | MSPS-119 | PRP, CSI, NARC, | 614 | 629 | 639 | 2225 | 958 | 552 | 907 | 500 | 800 | 869 |
| 4 | TM-1426 | AZRI, Bhakkar | 436 | 840 | 583 | 1702 | 597 | 378 | 1715 | 253 | 688 | 835 |
| 5 | GV-1 | ARI, Mingora, | 457 | 763 | 632 | 1469 | 1327 | 729 | 966 | 438 | 641 | 825 |
| 6 | NM-11 | Check | 521 | 631 | 660 | 2108 | 611 | 385 | 1140 | 451 | 791 | 811 |
| 7 | 13006 | PRI, AARI, Fsd | 414 | 688 | 604 | 1360 | 1356 | 743 | 869 | 653 | 558 | 805 |
| 8 | 14005 | PRI, AARI, Fsd | 522 | 727 | 674 | 1494 | 763 | 458 | 1226 | 628 | 737 | 803 |
| 9 | 14009 | PRI, AARI, Fsd | 407 | 754 | 590 | 1256 | 979 | 563 | 1222 | 597 | 814 | 798 |
| 10 | NCM-13 | PRI, CSI, NARC | 446 | 740 | 632 | 1900 | 871 | 510 | 894 | 455 | 527 | 775 |
| 11 | MH-16053 | NIAB, Fsd | 410 | 415 | 569 | 1823 | 1008 | 576 | 990 | 681 | 439 | 768 |
| 12 | AZRI Mung-2018 | Check | 413 | 642 | 611 | 1490 | 705 | 431 | 1356 | 479 | 479 | 734 |
| 13 | TM-1418 | AZRI Bhakkar | 447 | 488 | 625 | 1740 | 590 | 375 | 983 | 497 | 693 | 715 |
| 14 | AZRC-E2-18 | AZRC-D. I Khan | 756 | 342 | 632 | 1427 | 792 | 472 | 887 | 715 | 331 | 706 |
| 15 | MH-16058 | NIAB, Fsd | 563 | 646 | 639 | 1354 | 828 | 490 | 967 | 368 | 370 | 692 |
| 16 | NCM-11-Z | PRP, CSI, NARC, | 458 | 571 | 688 | 1744 | 416 | 292 | 929 | 524 | 573 | 688 |
| 17 | NIFA Mung-6 | NIFA, Tarnab, | 403 | 721 | 618 | 1510 | 603 | 382 | 850 | 448 | 592 | 681 |
| Location Means | | | 480 | 667 | 629 | 1672 | 862 | 506 | 1112 | 531 | 616 | |

Coefficient of variation= 14.03% Genotypes (G) Location (L) and G x L interactions are highly significant (P<0.01)

*Locations :

1 = AARI, Faisalabad 2 = AZRI, Bhakkar 3 = BARI, Chakwal, 4 = NIAB, Faisalabad
5 = AZRC, DI Khan 6=NIFA Peshawar, 7 = NARC, Islamabad, 8= BARS, Fatehjang,
9= AZRI, Umarkot

Note: The trial was sent to 12 locations. Grain Yield data received from 9 locations. So far grain yield data not received from 3 locations.

8- Title Pre-basic and Basic Seed Production

| Objectives | To maintain the genetic purity of approved cultivars. | | | | | | | | | | | | |
|--------------------------------|---|-------------------|----------------|-----------------|------------|------|------|---------------|-----|---|-------------------|-------------|-------------|
| Research worker(s) | Muhammad Sajjad Saeed, Dr. Busharat Hussain, Sadia Kaukab, Ch. Muhammad Rafiq, Mushtaq Ahmad & Tariq Mehmood. | | | | | | | | | | | | |
| Project duration | 2019 (continuous) | | | | | | | | | | | | |
| Location | Faisalabad & Kallurkot | | | | | | | | | | | | |
| Treatments/ Methodology | <p>Variety = AZRI M-2006 and PRI Mung-18.</p> <ul style="list-style-type: none"> • Selected seed of healthy and true to type single plants will be sown in plant to row progenies. • Selected plant to row progeny lines will be sown in separate progeny blocks. • Bulked seed of selected progeny blocks will be sown for the production of pre-basic seed. | | | | | | | | | | | | |
| Previous year's Results | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="text-align: left;">Entries/Varieties</th> <th>Pre-basic (Kg)</th> <th>Basic Seed (Kg)</th> </tr> </thead> <tbody> <tr> <td>ZRI-M-2006</td> <td>2200</td> <td>2710</td> </tr> <tr> <td>PRI Mung-2018</td> <td>125</td> <td>-</td> </tr> <tr> <td>Total (Kg)</td> <td>2325</td> <td>2710</td> </tr> </tbody> </table> | Entries/Varieties | Pre-basic (Kg) | Basic Seed (Kg) | ZRI-M-2006 | 2200 | 2710 | PRI Mung-2018 | 125 | - | Total (Kg) | 2325 | 2710 |
| Entries/Varieties | Pre-basic (Kg) | Basic Seed (Kg) | | | | | | | | | | | |
| ZRI-M-2006 | 2200 | 2710 | | | | | | | | | | | |
| PRI Mung-2018 | 125 | - | | | | | | | | | | | |
| Total (Kg) | 2325 | 2710 | | | | | | | | | | | |

9 - Title Impact of Plant Geometry on Yield and its Development

| | |
|---------------------------------|---|
| Objectives | To determine the optimum plant and row spacing of Mungbean. |
| Research Workers | Muhammad Sajjad Saeed, Muhammad Aqeel, Dr. Busharat Hussain, Sadia Kaukab & Ch. Muhammad Rafiq. |
| Project Duration | 2019 (continuous) |
| Location | Faisalabad |
| Treatments / Methodology | <p>Entries = 2 viz; V-13006 & PRI Mung-18.</p> <p>Row spacing = Viz; 3 (30cm, 45cm, 60cm)</p> <p>Plant spacing = Viz; 3 (7.5cm, 10cm, 15cm)</p> <p>Design = RCB</p> <p>Replications = 3</p> <p>Plot size = 1.2 m x 4m</p> <p>Sowing date = 2nd fortnight of June.</p> <p>Data to be recorded = Plant Stand, Days to 50 % flowering, days to 90 % maturity, plant height, number of pods/plant, pod length, number of seeds/pod, 1000 grain weight, seed yield and disease incidence.</p> |
| Previous year's Results | New Experiment |

10 - Title **Determination of Proper Sowing Dates to Overcome the Climatic Change.**

| | | |
|---------------------------------|---|---|
| Objectives | To find out proper sowing time for Mung bean cultivars. | |
| Research Workers | Muhammad Sajjad Saeed, Muhammad Aqeel, Dr. Busharat Hussain, Sadia Kaukab & Ch. Muhammad Rafiq. | |
| Project Duration | 2019 (continuous) | |
| Location | Faisalabad | |
| Treatments / Methodology | Entries | = 4 viz; PRI Mung-18, MG-14005, MG-15003 & MPP-15002 |
| | Design | = Split plot |
| | Replications | = 3 |
| | Plot size | = 1.2 m x 4m |
| | Row spacing | = 30cm |
| | Plant spacing | = 10 cm |
| | Sowing date | = 5viz: 25 th March, 1 st May, 16 th May, 1 st June & 1 st July. |
| | Data to be recorded | = Plant Stand, Days to 50 % flowering, days to 90 % maturity, plant height, number of pods/plant, pod length, number of seeds/pod, 1000 grain weight, seed yield and disease incidence. |
| Previous year's Results | New Experiment | |

11 - Title **Demonstration of Mung Bean as a catch crop in Rice-Wheat cropping system**

| | | |
|---------------------------------|---|---|
| Objectives | To introduce an additional crop of mung bean for uplifting the socio-economic conditions of the formers in rice-wheat system. | |
| Research Workers | Muhammad Sajjad Saeed, Muhammad Aqeel, Dr. Busharat Hussain, Sadia Kaukab, Ch. Muhammad Rafiq and Gulfam Riasat. | |
| Project Duration | 2015-20 (continuous) | |
| Location | Faisalabad | |
| Treatments / Methodology | Advance lines/ Varieties | = 4 viz; 15002,15003,15024 and 15039 Matures in 60 days |
| | | = Production technology of mung bean will be demonstrated among farmers of the area in Rice-Wheat cropping system |

Data to be recorded = The whole plot will be harvested and cost-benefit ratio will be calculated.

B - MASH (*Vigna mungo* L. Hepper) 2n = 22

12- Title Genepool Studies

| | |
|------------------------------------|--|
| Objectives | Collection, maintenance and evaluation of germplasm accessions for utilization in hybridization programme. |
| Research worker(s) | Amer Hussain, Muhammad Amir Amin, Irfan Rasool,, Muhammad Shafiq and Ch. Muhammad Rafiq |
| Project duration | 2019 (continuous) |
| Location | Faisalabad |
| Treatments/ Methodology | <p>No. of entries = 303(Local=70+USA=160+PGRI Islamabad+73)</p> <p>Plot size = 2.5 m x 0.6 m(paired rows)</p> <p>Row spacing = 30cm</p> <p>Plant spacing = 10cm</p> <p>Sowing time(Kharif) = 1st of July to 31st July</p> <p>(Spring) = 15th of March to 31st March</p> <p>Data to be taken = Plant stand, Plant type, Days to 50% flowering, Plant height, Number of pods/plant, Number of seeds/pod, 1000 Grain weight, Days to maturity, Seed yield, incidence of insect pests and Diseases.</p> |

Previous year's Results

| Trait | Range |
|---------------------|-------------------------|
| Plant type | Spreading to erect |
| Plant height | 22- 74 cm |
| No. of pods /plant | 12-148 |
| No. of seeds/ pod | 4-6 |
| 1000-grain weight | 25-45 g |
| Maturity days | 80-115 |
| Grain Colour | Black , brown and green |
| Grain yield / plant | 2.8 – 14.5 g |

303 entries out of 457 were evaluated and maintained.

13- Title Hybridization Programme

| | |
|------------------------------------|---|
| Objectives | To create genetic variability by crossing desirable parents |
| Research worker(s) | Amer Hussain, Muhammad Amir Amin and Muhammad Shafiq |
| Project duration | 2019 (continuous) |
| Location | Faisalabad |
| Treatments/ Methodology | Parents: 8 viz. M-97, Arooj-2011, ES-1, 62027, AARIM-65, AARIM-121, 17M011, US-221 |

| Cross Combinations=15 | | |
|-----------------------|---|---------------|
| High yield | X | ULCV Tolerant |
| 62027 | X | Arooj-11 |
| | X | Mash-97 |
| | X | ES-1 |
| AARIM-65 | X | Arooj-11 |
| | X | Mash-97 |
| | X | ES-1 |
| AARIM-121 | X | Arooj-11 |
| | X | Mash-97 |
| | X | ES-1 |
| 17M011 | X | Arooj-11 |
| | X | Mash-97 |
| | X | ES-1 |
| US-221 | X | Arooj-11 |
| | X | Mash-97 |
| | X | ES-1 |

| | |
|------------------|---|
| Planting pattern | = Paired rows of male and female parents. |
| Row spacing | = 30cm |
| Plant spacing | = 10cm |
| Sowing time | = 01/07, 15/07 and 30/07 |
| | Parental lines will be sown on different dates to find best seed setting period |

| | |
|--------------------------------|--|
| Previous year's Results | 25 cross combinations were attempted and 21 crosses were successfully harvested. |
|--------------------------------|--|

14- Title Study of Filial Generations

| | |
|---------------------------|---|
| Objectives | To select desirable genotypes from segregating generations. |
| Research worker(s) | Amer Hussain, Muhammad Amir Amin, and Muhammad Shafiq |
| Project duration | 2019 (continuous) |
| Location | Faisalabad. |

**Treatments/
Methodology**

| Filial generations | Crosses/progenies selected/harvested |
|--------------------|--------------------------------------|
| F ₁ | 21 |
| F ₂ | 11 |
| F ₃ | 6/18 |
| F ₄ | 7/20 |
| F ₅ | 6/16 |
| F ₆ | 2/6 |

Row Length = 4 m

Row spacing = 60 cm

Plant spacing = 15 cm

Sowing time(Kharif) = 1st July to 31st July

(Spring) = 15th March to 31st March

**Previous years
Results**

| Filial generations | Crosses/progenies studied | Crosses/progenies selected/harvested |
|--------------------|---------------------------|--------------------------------------|
| F ₁ | 11 | 11 |
| F ₂ | 6 | 6/18 |
| F ₃ | 7/21 | 7/20 |
| F ₄ | 6/18 | 6/16 |
| F ₅ | 2/5 | 2/6 |
| F ₆ | 5/14 | 5/10 5 lines were selected |

15- Title**Preliminary Yield Trial - 1****Objectives**

To evaluate promising lines for yield potential.

Research worker(s)

Amer Hussain, Muhammad Amir Amin, Muhammad Shafiq and
Ch. Muhammad Rafiq

Project duration

2019 (continuous)

Location

Faisalabad

| | | |
|------------------------------------|---------------|---|
| Treatments/ Methodology | Entries | = 12 viz; 19M001,19M002,19M003,19M004, 19M005,19M006,19M007,19M008, 19M009,19M010,19M011,19M012 |
| | Checks | = Mash-97 & Arooj-11 |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 4m x 1.2m |
| | Row spacing | = 30 cm |
| | Plant spacing | = 10 cm |
| | Planting date | = Kharif (1 st of July to 31 st July) Spring(15 th March to 31 st March) |
| | Data Recorded | plant stand, growth habit, Day to 50% Flowering, Plant height, number of pods/plants, , number of eeds/pod, 1000 grain weight, days to maturity, seed yield. |

**Previous year's
Results**

Spring 2018

| Yield Kg/ha | | |
|-------------|------------------|------------|
| Rank # | Entry No. | Faisalabad |
| 1. | 18M008 | 1958 |
| 2. | 18M013 | 1948 |
| 3. | MASH-97 (Check) | 1843 |
| 4. | AROOJ-11(Check) | 1829 |
| 5. | 18M010 | 1812 |
| 6. | 18M006 | 1621 |
| 7. | 18M009 | 1606 |
| 8. | 18M007 | 1600 |
| 9. | 18M012 | 1533 |
| 10. | 18M001 | 1510 |
| 11. | 18M005 | 1479 |
| 12. | 18M004 | 1460 |
| 13. | 18M011 | 1367 |
| 14. | 18M014 | 1312 |
| 15. | 18M003 | 1081 |
| 16. | 18M002 | 971 |
| | C.V.% | 18.47 |

Kharif-2018

| Yield Kg/ha | | |
|-------------|------------------|------------|
| Rank # | Entry No. | Faisalabad |
| 1. | 18M013 | 833 |
| 2. | 18M006 | 752 |
| 3. | 18M009 | 669 |
| 4. | AROOJ-11 (Check) | 606 |
| 5. | MASH-97 (Check) | 602 |
| 6. | 18M003 | 594 |
| 7. | 18M008 | 548 |
| 8. | 18M005 | 546 |
| 9. | 18M001 | 537 |
| 10. | 18M010 | 523 |
| 11. | 18M011 | 506 |
| 12. | 18M014 | 460 |
| 13. | 18M004 | 450 |
| 14. | 18M007 | 431 |
| 15. | 18M002 | 367 |
| 16. | 18M012 | 431 |
| | C.V.% | 16.26 |

16- Title Preliminary Yield Trial - 2

| | | |
|--------------------------------|--|---|
| Objectives | To evaluate promising lines for yield potential. | |
| Research worker(s) | Amer Hussain, Muhammad Amir Amin, Muhammad Shafiq and Ch. Muhammad Rafiq | |
| Project duration | 2019 (continuous) | |
| Location | Faisalabad | |
| Treatments/ Methodology | Entries | = 12 viz; 19M013,19M014,19M015,19M016, 19M017,19M018,19M019,19M020, 19M021,19M022,19M023,19M024 |
| | Checks | = Mash-97 & Arooj-11 |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 4m x 1.2m |
| | Row spacing | = 30 cm |
| | Plant spacing | = 10 cm |
| | Planting date | = Kharif (1 st of July to 31 st July) Spring (15 th March to 31 st March) |
| | Data Recorded | plant stand, growth habit, Day to 50% Flowering, Plant height, number of pods/plants, , number of seeds/pod, 1000 grain weight, days to maturity, seed yield. |

Previous year's Results New experiment.

17- Title **Advanced Yield Trial**

| | | |
|--------------------------------|--|--|
| Objectives | To identify high yielding lines under different agro climatic conditions. | |
| Research worker(s) | Amer Hussain,, Muhammad Shafiq Tariq, Muhammad Shafiq and Ch. Muhammad Rafiq | |
| Project duration | 2019 (continuous) | |
| Location | Faisalabad and Sahowali | |
| Treatments/ Methodology | Entries | = 10 viz, 18M004,18M005,18M006,18M007,18M008, 18M009,18M010,18M011,18M013,18M014 |
| | Checks | = Mash-97 & Arooj |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 4m x 1.2m |
| | Row spacing | = 30 cm |
| | Plant spacing | = 10 cm |
| | Planting date | = Kharif (1 st of July to 31 st July) Spring(15 th March to 31 st March) |
| | Data to be recorded | = Plant stand, Growth habit, Days to 50% flowering, Plant height, number of pods/plant, number of seeds/pod, 1000 grain weight, days to maturity, seed yield, Incidence of insect pests and diseases. |

Previous year's
Results

SPRING-2018

| Yield Kg/ha | | |
|-------------|------------------|------------|
| Rank # | Entry No. | Faisalabad |
| 1. | 17M011 | 2835 |
| 2. | 17M013 | 2708 |
| 3. | 17M007 | 2669 |
| 4. | AROOJ-11 (Check) | 2585 |
| 5. | 17M008 | 2496 |
| 6. | 17M010 | 2469 |
| 7. | 17M009 | 2417 |
| 8. | 17M012 | 2390 |
| 9. | 17M005 | 2377 |
| 10. | 17M014 | 2312 |
| 11. | 17M006 | 2123 |
| 12 | MASH-97 (Check) | 1715 |
| | C.V.% | 9.85 |

KHARIF-2018

| Yield Kg/ha | | |
|-------------|------------------|------------|
| Rank # | Entry No. | Faisalabad |
| 1. | 17M008 | 652 |
| 2. | 17M007 | 633 |
| 3. | 17M012 | 600 |
| 4. | Mash-97 (Check) | 585 |
| 5. | 17M009 | 581 |
| 6. | Arooj-11 (Check) | 579 |
| 7. | 17M014 | 560 |
| 8. | 17M011 | 525 |
| 9. | 17M006 | 521 |
| 10. | 17M010 | 517 |
| 11. | 17M013 | 475 |
| 12 | 17M005 | 400 |
| | C.V.% | 16.67 |

Advance Yield Trial was completely damaged due to rains in Sahowali, Sialkot.

18- Title **Micro Yield Trial**

| | | |
|------------------------------------|--|---|
| Objectives | To select better performing and well adapted lines suitable for different ecological zones of Punjab | |
| Research worker(s) | Amer Hussain, Muhammad Shafiq Tariq and Muhammad Shafiq. | |
| Project duration | 2019 (continuous) | |
| Location | Faisalabad, Sahowali | |
| Treatments/ Methodology | Entries | = 14 viz; 16M004,16M005,16M006,16M008,17M005, 17M006,17M007,17M008,17M009,17M010, 17M011,17M012,17M013,17M014 |
| | Checks | = Mash-97 & Arooj-11 |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 4m x 1.2m |
| | Row spacing | = 30 cm |
| | Plant spacing | = 10 cm |
| | Planting date | = Kharif (1 st of July to 31 st July) Spring(15 th March to 31 st March) |
| | Data to be recorded | = Plant stand, Growth habit, Days to 50% flowering, Plant height, number of pods/plant, number of seeds/pod, 1000 grain weight, days to maturity, seed yield, Incidence of insect pests and diseases. |

Previous year's
Results

SPRING-2018

| Yield Kg/ha | | |
|-------------|------------------|------------|
| Rank # | Entry No. | Faisalabad |
| 1. | 16M006 | 2623 |
| 2. | AROOJ-11 (Check) | 2612 |
| 3. | 16M005 | 2579 |
| 4. | 16M004 | 2512 |
| 5. | 16M008 | 2421 |
| 6. | 16M010 | 2333 |
| 7. | 16M003 | 2315 |
| 8. | 16M002 | 2229 |
| 9. | 16M001 | 2227 |
| 10. | 16M009 | 2121 |
| 11. | 16M007 | 2065 |
| 12. | MASH-97 (Check) | 1398 |
| | C.V.% | 9.99 |

KHARIF-2018

| Yield Kg/ha | | |
|-------------|------------------|------------|
| Rank # | Entry No. | Faisalabad |
| 1. | 16M004 | 754 |
| 2. | MASH-97 (Check) | 737 |
| 3. | 16M006 | 723 |
| 4. | AROOJ-11 (Check) | 717 |
| 5. | 16M010 | 625 |
| 6. | 16M002 | 606 |
| 7. | 16M001 | 598 |
| 8. | 16M007 | 596 |
| 9. | 16M005 | 567 |
| 10. | 16M008 | 565 |
| 11. | 16M003 | 517 |
| 12. | 16M009 | 425 |

| | | |
|--|--------------|-------|
| | C.V.% | 12.15 |
|--|--------------|-------|

Micro Yield Trial was completely damaged due to rains in Sahowali, Sialkot

19- Title **Pre Basic/Basic Seed Production**

| | |
|------------------------------------|---|
| Objectives | To maintain the genetic purity of approved cultivars. |
| Research worker(s) | Amer Hussain, Mushtaq Ahmad, Muhammad Shafiq Tariq, Muhammad Shafiq and Ch. Muhammad Rafiq |
| Project duration | 2019 (continuous) |
| Location | Faisalabad, Kallur kot & Sahowali |
| Treatments/ Methodology | <p>Approved cultivars = Mash-97 & Arooj -11</p> <p>Selected seed of healthy and true to type single plants will be sown in plant to row progenies.</p> <p>Selected plant to row progeny lines will be sown in separate progeny blocks.</p> <p>Bulked seed of selected progeny blocks will be raised for the production of pre-basic seed.</p> |

Previous year's Results

| S # | Entries/Lines | Pre-Basic (Kgs) | Basic Seed (Kgs) |
|-----|---------------|-----------------|------------------|
| 1. | Arooj-2011 | 357 | 1934 |

20 - Title **National Uniform Yield Trial**

| | |
|---------------------------|--|
| Objectives | To test the performance of candidate Mashbean cultivars of different institutes. |
| Research worker(s) | , Amer Hussain, Muhammad Amir Amin and Muhammad Shafiq |
| Project duration | 2019 (continuous) |
| Location | Faisalabad |

**Treatments/
Methodology**

Entries will be provided by Pulses Coordinator.

Layout = As per instructions from the National Coordinator, Pulses NARC, Islamabad.

Sowing date = 1st of July to 31st July

Data to be taken = Plant stand, Plant type, Days to 50% flowering, Plant height, Number of pods/plant, Number of seeds/pod, 1000 Grain weight, Days to maturity, Seed yield, Attack of insect pests and Disease reaction

**Previous year's
results****Grain Yield (kg/ha)**

| Entry # | Entry name | Source | Locations* | | | | | MEAN |
|----------------|-------------|---------------------------|------------|-----|------|-----|-----|------|
| | | | 1 | 2 | 3 | 4 | 5 | |
| 1 | NMS-16-15 | PRP, CSI, NARC, Islamabad | 413 | 590 | 1059 | 483 | 578 | 624 |
| 2 | Arooj Mash | (Check) | 375 | 542 | 958 | 463 | 728 | 613 |
| 3 | NMS-16-16 | PRP, CSI, NARC, Islamabad | 353 | 618 | 1000 | 549 | 517 | 607 |
| 4 | Mash NARC-3 | (Check) | 422 | 611 | 960 | 431 | 469 | 579 |
| 5 | NMS-16-14 | PRP, CSI, NARC, Islamabad | 515 | 528 | 804 | 497 | 432 | 555 |
| 6 | 15-M-005 | PRI, AARI, Faisalabad | 455 | 563 | 803 | 389 | 512 | 544 |
| 7 | 13-CM-708 | BARI, Chakwal | 385 | 597 | 743 | 449 | 296 | 494 |
| Location Means | | | 417 | 578 | 904 | 466 | 504 | |

***Locations**

| | | | | |
|---------------------|------------------|--------------|--------------------|--------------------|
| 1= AARI, Faisalabad | 2= BARI, Chakwal | 3= ARI, Swat | 4= BARS, Fatehjang | 5= NARC, Islamabad |
|---------------------|------------------|--------------|--------------------|--------------------|

C - COWPEAS (*Vigna sinensis*) 2n = 22

21- Title Germplasm Studies

| | | | | | | | | | | | | | | | |
|------------------------------------|---|---------|-----------|-------|--------------|-----------|--------------|-------------|---------|---------------|---------|---------------|-------------------------------------|------------------|---|
| Objectives | Collection, maintenance and evaluation of elite lines / genotypes for their utilization in hybridization programme. | | | | | | | | | | | | | | |
| Research worker(s) | Muhammad Amir Amin, Dr.Anwar-ul-Haq, and Ch. Muhammad Rafiq | | | | | | | | | | | | | | |
| Project duration | 2019 (Continuous) | | | | | | | | | | | | | | |
| Location | Faisalabad | | | | | | | | | | | | | | |
| Treatments/ Methodology | <table> <tr> <td>Entries</td> <td>=51+9= 60</td> </tr> <tr> <td>Check</td> <td>= S.A. Dandy</td> </tr> <tr> <td>Plot size</td> <td>= 5 m x 1.2m</td> </tr> <tr> <td>Row spacing</td> <td>= 60 cm</td> </tr> <tr> <td>Plant spacing</td> <td>= 20 cm</td> </tr> <tr> <td>Planting time</td> <td>= 2nd fortnight of june</td> </tr> <tr> <td>Data to be taken</td> <td>= Plant type, leaf colour, flower colour, number of pods/plant, number of seeds/ pod, 100 grain weight, days to maturity.</td> </tr> </table> | Entries | =51+9= 60 | Check | = S.A. Dandy | Plot size | = 5 m x 1.2m | Row spacing | = 60 cm | Plant spacing | = 20 cm | Planting time | = 2 nd fortnight of june | Data to be taken | = Plant type, leaf colour, flower colour, number of pods/plant, number of seeds/ pod, 100 grain weight, days to maturity. |
| Entries | =51+9= 60 | | | | | | | | | | | | | | |
| Check | = S.A. Dandy | | | | | | | | | | | | | | |
| Plot size | = 5 m x 1.2m | | | | | | | | | | | | | | |
| Row spacing | = 60 cm | | | | | | | | | | | | | | |
| Plant spacing | = 20 cm | | | | | | | | | | | | | | |
| Planting time | = 2 nd fortnight of june | | | | | | | | | | | | | | |
| Data to be taken | = Plant type, leaf colour, flower colour, number of pods/plant, number of seeds/ pod, 100 grain weight, days to maturity. | | | | | | | | | | | | | | |

Previous year's Results

| Trait | Range |
|---------------------------|---------------------------|
| Plant type | Erect to Spreading |
| Flower colour | White and Purple |
| Leaf colour | Light green to Dark green |
| No. of pods /plant | 20-98 |
| No.of seeds/ pod | 4-19 |
| Days to Flower initiation | 45-70 |
| Maturity days | 105-132 |
| 100-grain weight | 11-34 g |

51 entries were evaluated and maintained

22- Title Hybridization Programme

| | |
|---------------------------|--|
| Objectives | To create genetic variability for incorporation of desirable traits. |
| Research worker(s) | Muhammad Amir Amin, Dr. Anwar-ul-Haq and Ch. Muhammad Rafiq |
| Project duration | 2019 (continuous) |
| Location | Faisalabad |

**Treatments/
Methodology**

Parents: =7 viz. CP-002, CP-017, CP-020, CP-030, CP-034, CP-037
& CP- 072

| Cross combinations | | |
|--------------------|----------|-------------------|
| | | |
| High yield | x | Erect type |
| CP-017 | x | CP-002 |
| | x | CP-034 |
| | x | CP-037 |
| CP-030 | x | CP-002 |
| | x | CP-034 |
| | x | CP-037 |
| CP-072 | x | CP-002 |
| | x | CP-034 |
| | x | CP-037 |
| CP-020 | x | CP-002 |
| | x | CP-034 |
| | x | CP-037 |

Row spacing = 60 cm

Plant spacing = 20 cm

Planting time = 2nd fortnight of August & 1st fortnight of September

**Previous year's
Results**

Harvested 5 successful crosses

23- Title Study of Filial Generations

Objectives To evaluate various segregating generations for selecting desirable genotypes.

Research worker(s) Muhammad Amir Amin, Dr. Anwar-ul-Haq and Muhammad Shafiq

Project duration 2019 (continuous)

Location Faisalabad.

| Treatments/ Methodology | Filial generation | Crosses/ progenies |
|------------------------------------|--------------------------|--------------------------------------|
| | F1 | = 5 crosses |
| | F2 | = 3crosses |
| | Row Length | = 4m |
| | Row spacing | = 60 cm |
| | Plant spacing | = 20cm |
| | Planting time | = 2 nd fortnight of June. |

24. Title Preliminary Yield Trial

| | | |
|------------------------------------|---|--|
| Objectives | To evaluate promising lines for high yield potential. | |
| Research worker(s) | Muhammad Amir Amin, Dr. Anwar-ul-Haq, , Muhammad Shafiq Ch. Muhammad Rafiq | |
| Project duration | 2019 (Continuous) | |
| Location | Faisalabad | |
| Treatments/ Methodology | Entries | = 9 Viz; CP-002, CP-003, CP-014, CP-018, CP-020, CP-050, CP-009, CP-019 & CP-024 |
| | Check | = S.A. Dandy |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 5 m x 3.0m |
| | Row spacing | = 60 cm |
| | Plant spacing | = 20cm |
| | Planting time | = 2 nd fortnight of june |
| | Data to be taken | = Plant stand, Days to 50 % flowering, plant type, days to maturity, disease incidence, number of pods/plant, flower colour, number of seeds/pod, 100 grain weight and seed yield. |

Previous year's Results

| Rank | Entry | Yield kg/ha |
|------|-------------------|-------------|
| 1. | CP-072 | 737 |
| 2. | S A Dandy (CHECK) | 701 |
| 3. | CP-037 | 698 |
| 4. | CP-101 | 634 |
| 5. | CP-034 | 633 |
| 6. | CP-030 | 561 |
| 7. | CP-060 | 541 |
| 8. | CP-008 | 525 |
| 9. | CP-040 | 491 |
| 10. | JK-001 | 467 |

25- Title **Advanced Yield Trial**

| | | |
|------------------------------------|--|---|
| Objectives | To select high yielding, well-adapted and disease resistant lines. | |
| Research worker(s) | Muhammad Amir Amin, Dr. Anwar-ul-Haq and Muhammad Shafiq | |
| Project duration | 2019 (Continuous) | |
| Location | Faisalabad | |
| Treatments/ Methodology | Entries | = 9 viz; CP-008, CP-030, CP-034, CP-037, CP-040, CP-060, CP-072 , JK-001 & CP-101 |
| | Check | = S.A. Dandy |
| | Design | = RCB |
| | Replications | = 3 |
| | Plot size | = 5 m x 3.0 m |
| | Row spacing | = 60 cm |
| | Plant spacing | = 20cm |
| | Planting time | = 2 nd fortnight of June |
| | Data to be taken | = Plant stand, Days to 50 % flowering, plant type, days to maturity, disease incidence, number of pods/plant, flower color, number of seeds/pod, 100 grain weight and seed yield. |

Previous year's results

| Rank | Entry | Yield kg/ha |
|------|-------------------|-------------|
| 1. | CP-100 | 793 |
| 2. | S A Dandy (CHECK) | 755 |
| 3. | CP-096 | 744 |
| 4. | CP-070 | 715 |
| 5. | CP-077 | 710 |
| 6. | CP-002 | 674 |
| 7. | CP-075 | 653 |
| 8. | CP-076 | 650 |
| 9. | CP-029 | 583 |
| 10. | CP-085 | 578 |

26. Title **Micro Yield Trial**

| | | | |
|------------------------------------|--|---|--|
| Objectives | To select high yielding, well-adapted and disease resistant lines. | | |
| Research worker(s) | Muhammad Amir Amin, Dr. Anwar-ul-Haq and Muhammad Shafiq | | |
| Project duration | 2019 (Continuous) | | |
| Location | Faisalabad, Kallurkot and Sahowali | | |
| Treatments/ Methodology | Entries | = 09 viz; CP-002, CP-029, CP-070, CP-075, CP-076, CP-077, CP-085, CP-096 & CP-100 | |
| | Check | = S.A. Dandy | |
| | Design | = RCB | |
| | Replications | =3 | |
| | Plot size | = 5 m x 3 m | |
| | Row spacing | = 60 cm | |
| | Plant spacing | = 20 cm | |
| | Planting time | = 2 nd fortnight of June | |
| | Data to be taken | = Plant stand, Days to 50 % flowering, plant type, days to maturity, disease incidence, number of pods/plant, flower color, number of seeds/pod, 100 grain weight and seed yield. | |

Previous year's Results

| Rank | Entry No. | Location | | | Av. Yield kg/ha |
|------|-------------------|------------|------------|----------|--------------------|
| | | Faisalabad | Kallur kot | Sahowali | |
| 1 | CP-032 | 522 | 528 | 915 | 655 |
| 2 | CP-065 | 657 | 562 | 598 | 606 |
| 3 | CP-036 | 547 | 486 | 711 | 581 |
| 4 | CP-054 | 485 | 549 | 622 | 552 |
| 5 | CP-016 | 542 | 583 | 503 | 543 |
| 6 | S A Dandy (CHECK) | 592 | 396 | 565 | 518 |
| 7 | CP-058 | 523 | 556 | 440 | 506 |
| 8 | CP-067 | 559 | 389 | 569 | 506 |
| 9 | CP-064 | 503 | 500 | 395 | 466 |
| 10 | CP-086 | 578 | 382 | 433 | 464 |

27- Title Seed Multiplication Trial

| | | |
|------------------------------------|--|---------------------------|
| Objectives | To multiply the seed of advance lines | |
| Research worker(s) | Muhammad Amir Amin, Dr. Anwar-ul-Haq and Muhammad Shafiq | |
| Project duration | 2019 (continuous) | |
| Location | Faisalabad | |
| Treatments/ Methodology | Entries | = CP-017, CP-037 & CP-065 |
| | Row spacing | = 60 cm |
| | Plant spacing | = 20 cm |

D. PLANT PATHOLOGY

28. Title **SCREENING OF MUNGBEAN (*Vigna radiata* (L.) Wilczek) PROMISING LINES/ VARIETIES FOR RESISTANCE/ TOLERANCE TO MUNGBEAN YELLOW MOSAIC VIRUS (MYMV) AND URDBEAN LEAF CRINKLE VIRUS (ULCV)**

Objectives To select mungbean cultivars/lines resistant/tolerant to Mung bean Yellow Mosaic Virus and Urdbean Leaf Crinkle Virus.

Research worker(s) Javed Anwar Shah, Dr. M. Azhar Iqbal and Javed Ihsan

Project duration 2019

Location Faisalabad (PRI)

Treatments 100 Advance lines

Methodology Each entry will be planted in 3-meter-long and 30 cm apart single row during the 1st week of July in three replications. A highly susceptible variety **Mung Kabuli** will be sown as spreader after every two test entries.

Observations on the incidence of MYMV and ULCV will be recorded under field conditions at Seedling and Maturity stage according to disease rating scale (

Khalid *et al.*, 2011).

Previous Years Results

| REACTION | LINES / VARIETIES (MYMV) | LINES / VARIETIES (ULCV) |
|------------------------|--|--------------------------|
| Highly Resistant | - | - |
| Resistant | - | - |
| Moderately Resistant | Line No.,RC-63,77,161,166,167,303, ,230-27-680-4,11-2,E-182-1,NM-92 10-10 & Kark-2 | - |
| Moderately Susceptible | Line No54,E136SP,97001,Line No.168SP, Ranzansp, TM1426SP,LineN07-1SP,1428SP, Line No.103SP LA-10-27SP,Line No.10-71SP, 08009,6601-ASP,Line No-107, BRM-14,M-002,E-28-1,E-6368-40-404SP ,M-19-19,LNO-3,LineNo-27,NM-98 NIFA-5,NM-12,C2-94-3-4,Kark-1,LineNo.10-76, Line No-10-39,Line No-120SP,Line No-68, 632-72 ,E-6,LineNo. 177,E-33,M- ,97017, M0001,NM-114 ,4506, 6133-538-4,97007, NM-5,6149-5-12,Line No.7 , Line o.907,98006,LineNo.162-63 & NM2001 | - |
| Susceptible | NM4,6163B-4SP,E-39SP,N2-31SP,E-86SP, 09TM-4SP,LineNo.11SP,Australia sb,NM- | |

| | | |
|--------------------|---|---|
| | 28,V1059228, Line No-37SP,NM-1,Line NO-127,63772, 0173-4-10 ,1977,E-112-1, NM-14,NIFA-2 ,LA-10-27,77121-121-25,Line No.162-B,M005,LineNo.7-1,NM-28 A-8,C2-94-4-36, S-907,0173-4-10,4CM4-516 & E-235 | |
| Highly Susceptible | NM-54SP,NM-06SP,97-12-SP,AUMC-9801 M-003,M-303 &NM-10 | - |

29. Title **SCREENING OF MASH (*Vigna mungo* (L.) Hepper) LINES/ VARIETIES FOR RESISTANCE/ TOLERANCE TO URDBEAN LEAF CRINKLE VIRUS (ULCV) AND MUNGBEAN YELLOW MOSAIC VIRUS (MYMV)**

| | |
|---------------------------|--|
| Objectives | To select mash cultivars/lines, resistant/tolerant to Urdbean Leaf Crinkle Virus and Mung bean Yellow Mosaic Virus |
| Research worker(s) | Dr. M. Azhar Iqbal, Javed Ihsan and Javed Anwar Shah |
| Project duration | 2019 |
| Location | Faisalabad (PRI) |
| Treatments | 50 advance lines/Varieties |
| Methodology | Each entry will be planted in 3-meter-long and 30cm apart single row during the 1 st week of July in three replications. A highly susceptible variety Kandhari Mash will be sown as spreader after every two test entries. Observations on the incidence of ULCV and MYMV will be recorded under field conditions at Seedling stage and Maturity according to disease rating scale (Khalid <i>et al.</i> , 2011). |

Previous Years Results

| REACTION | LINES/ VARIETIES (MYMV) | LINES/ VARIETIES (ULCV) |
|------------------------|--|--|
| Highly Resistant | - | |
| Resistant | 18M002,18M003,18M012,17M005,17M006,17M010,17M013,16M002,16M006,16M007,16M010 and ES-1 | 18M003,18M008,18M010,17M007,17M011,17M012,17M013,16M004,15M001,15M002,15M003,15M006,15M007,15M008, Mash-97,Arooj, ES-1,4CM716, MashSPN-1,MashSPN-2 |
| Moderately Resistant | 18M001,18M010,17M007,17M012, 16M003,16M008, 15M007 and 1636-21 | 18M004,18M005,18M006,18M009,18M012,17M006,17M009,17M010,16M002 and 15M005 |
| Moderately Susceptible | 18M005,18M007,18M009,18M011,18M013,18M014,17M008,17M011,17M014,16M001,16M004,16M009,15M001 | 18M002,18M007,18M011,18M013,18M014,17M005,17M008,17M014 |

| | | |
|--------------------|---|--|
| | 01,15M003,15M005,Mash97,Arooj,62027,4CM716 & MashSPN-2 | 16M001,16M003 16M009,16M010 15M004 & 62027 |
| Susceptible | 18M004,18M006,18M008,17M009,15M002,15M004,15M006,15M008 MashSPN-1 | 18M001,16M006 16M007,16M008 6036-21 |
| Highly Susceptible | Mash Kahandri | Mash Kahandari |

30. Title **SCREENING OF COWPEAS (*Vigna sinensis*) PROMISING LINES FOR RESISTANCE/ TOLERANCE TO COWPEA YELLOW MOSAIC VIRUS (CYMV)**

Objectives To select cultivars/lines, resistant/tolerant to CYMV

Research worker(s) Javed Anwar Shah , Javed Ihsan and Dr. M. Azhar Iqbal

Project duration 2019

Location Faisalabad (PRI)

Treatments 10 advance lines/Varieties

Methodology Each entry will be planted in 3 meter long and 30cm apart single row during the 1st week of July having three replications. A highly susceptible **Desi Arvan** will be sown after every two test entries. Observations on the virus incidence will be recorded under field conditions at seedling and maturity, according to disease rating scale (Khalid *et al.*, 2011).

Previous Years Results

| REACTION | LINES/ VARIETIES |
|------------------------|---|
| Highly Resistant | CP-016,CP-017,CP-032,CP-036,CP-054,CP-058 , CP-064,CP-065,CP-067 and CP-086 |
| Resistant | |
| Moderately Resistant | - |
| Moderately Susceptible | - |
| Susceptible | - |
| Highly Susceptible | - |

31. Title **Screening of Mungbean (*Vigna radiata* (L.) Wilczek) Lines for Resistance/ Tolerance to *Cercospora* leaf spot**

Objectives To select Mungbean cultivars/ lines resistant/ tolerant to *Cercospora canesens* for use in hybridization programme.

Research worker(s) Javed Ihsan, Dr. M. Azhar Iqbal and Javed Anwar Shah

Project duration 2019

Location Faisalabad (PRI)

Treatments 20 lines/ Varieties

Methodology Each Entry will be planted in 3 meter long and 30 cm apart single row during the first week of July having three replications.

PULSES RESEARCH INSTITUTE, FAISALABAD 14003 will be sown as spreader after every two test

entries. The severity of disease will be recorded by using scale 0-9 (C.D.MAYEE & V.V DATAR, 1986) in natural conditions.

**Previous Years
Results**

| Scale | Reaction | Lines / Varieties |
|-------|----------------------|---|
| 0 | Immune | - |
| 1 | Highly Resistant | - |
| 3 | Resistant | 16051 |
| 5 | Moderately Resistant | 16004,16005,16015,16016,16017,16019,16020,16023,16024,16039,16053 , 16058 16059,16064,16071,16090 ,and 16091 |
| 7 | Susceptible | 16022 and 16078 |
| 9 | Highly Susceptible | - |

32. TITLE

MANAGEMENT OF CERCOSPORA LEAF SPOT (*Cercospora canescens*) in MUNG BEAN (*Vigna radiata* (L.) Wilczek) BY USING SYSTEMIC AND NON-SYSTEMIC FUNGICIDES

Objectives

To see the effect of using systemic and non-systemic fungicides measures for the management of Cercospora leaf spot (*Cercospora canescens*) in Mungbean.

Research worker(s)

Javed Anwar Shah, Dr. M. Azhar Iqbal and Javed Ihsan

Project duration

2019

Location

Faisalabad (PRI)

Treatments

Variety = 14003

- T₁ Curzate 72WP@ 600 gm/ 100L water
- T₂ Score 250 EC@ 120 ml/100L water
- T₃ Mencozeb @ 250gm / 100L water
- T₄ Tilt 250 EC @ 100ml / 100L water
- T₅ Antracol 70 wp@ 250 gm/100L water
- T₆ Metalaxyl + Mancozeb 250gm/100L water
- T₀ Control (H₂O)

Methodology

Cercospora leaf spot (CLS) susceptible variety 14003 will be sown in RCBD having 3 replications with 1x4m subplots. The inoculum will be sprayed after 40-45 days of sowing to create disease epidemic. The test fungicides will be sprayed after the appearance of the disease. The severity of disease will be recorded after 7 days interval by using scale 0-9 (C.D.MAYEE & V.V DATAR, 1986)

**Previous Years
Results**

First year of experiment

E. ENTOMOLOGY

33. TITLE Efficacy Of Different insecticides against whitefly on Mash crop..

Objectives To identify the most effective insecticide for the control of whitefly.

Research workers Ali Aziz

Project duration 2019

Location Faisalabad

**Treatments/
Methodology**

1. Pyriproxyfen 10.8 EC @ 500 ml/acre
2. Imidacloprid 200SL @ 250 ml/acre
3. Buprofezin 25 WP @ 600 gm/acre
4. Flonicamid 50 WG @ 80 gm/ acre
5. Acetamiprid 20 SP @ 125 gm/acre
6. Dinotefuran 20 SG @ 120 gm/acre
7. Water
8. Check

Layout = RCBD

Replications = 3

Row spacing = 30 cm

Plant spacing = 10 cm

Plot size = 4.0 m x 1.2 m

Date of Sowing = 1st fortnight of July

Data to be taken = The population of sucking insect pests will be recorded per leaf before spray and then after 3 and 7 days of spray from 15 randomly selected leaves at random from each plot. Finally, the data will be analyzed statistically.

**Previous year's
Results** First year

34. TITLE Efficacy Of Different insecticides against Spinola

bug on Mung crop

| | |
|-------------------------|---|
| Objectives | To identify the most effective insecticide for the control of Spinola bug |
| Research workers | Ali Aziz |
| Project duration | 2019 |
| Location | Faisalabad |

Treatments/ Methodology

1. (Abamectin+ bifenthrin)56 EC @ 500 ml/acre
2. Imidacloprid 200SL @ 250 ml/acre
3. (Imidacloprid+ fipronyl) 80 WG @ 60 gm/acre
4. Carbosulfan 20 EC@ 500mL/acre
5. Dimethoate 40 EC@ 400 ml/acre
6. Cypermethrin + Profenofos (200ml /acre + 400 ml /acre)
7. Check /acre

Data to be taken = The Data for spinola bugs will be taken by observing no. of damaged and healthy pods per plant on 5 randomly selected plants from each plot before spray and then after 3 and 7 days of spray. Finally, the data will be analyzed statistically.

Previous year's Results

First year

F. BACTERIOLOGY

35. TITLE RESPONSE OF MUNGBEAN TO RHIZOBIUM AND PGPR CO-INOCULATION

| | |
|------------------------------------|---|
| Objectives | To identify the best suited Rhizobium-PGPR co- inoculation for optimum mung bean production |
| Research workers | Dr. Shakeel Ahmad Anwar and Muhammad Sajjad Saeed in collaboration with Soil Bacteriology Section, AARI, FSD. |
| Project duration | 2017-2019 |
| Location | Faisalabad |
| Treatments/ Methodology | <p>Variety: = AZRI-2006</p> <p>Treatments: = 6</p> <p>T1- Control (25-60-0)</p> <p>T2- Rhizobium sp. of Mung bean</p> <p>T3- Azoto bacter (PGPR₁)</p> <p>T4- Bacillus (PGPR₂)</p> <p>T5- Rhizobium + PGPR₁</p> <p>T6- Rhizobium + PGPR₂</p> <p>Layout: = RCBD</p> <p>Replication: = 3</p> <p>Plot size: = 4 m x 1.2 m</p> <p>Row spacing: = 30 cm</p> <p>Plant spacing: = 10 cm</p> <p>Sowing date: = 15 June – 15 July</p> |

Recommended dose of fertilizers will be added to the soil prior to sowing. Rhizobium as well as PGPR culture as per treatment will be applied to seed before sowing. Data for Plant height, No. of branches, No. of pods per plant, 1000 grain weight and grain yield will be recorded. Pre sowing and post-harvest soil analysis for P, K and Organic matter will be carried out

Previous year's Results

| Treatments | Nodules Plant ⁻¹ | Plant Height (cm) | Secondary branches plant ⁻¹ | Pods Plant ⁻¹ | 1000 grain weight (g) | Grain yield (kg ha ⁻¹) |
|------------|-----------------------------|-------------------|--|--------------------------|-----------------------|------------------------------------|
| T1 | 12.7 | 35.2 | 2.5 | 10.9 | 48.4 | 1496.9 |
| T2 | 17.2 | 44.3 | 3.2 | 16.9 | 55.4 | 2192.3 |
| T3 | 17.0 | 40.7 | 3.5 | 13.7 | 53.7 | 1987.4 |
| T4 | 16.5 | 40.2 | 3.2 | 14.0 | 53.0 | 1711.8 |
| T5 | 15.2 | 41.5 | 3.3 | 13.2 | 52.6 | 1832.1 |
| T6 | 16.2 | 40.8 | 3.3 | 14.1 | 53.6 | 1803.1 |

| Treatments | Ash | Crude Protein | Crude Fat | Crude Fiber |
|------------|-----------------|---------------|-----------|-------------|
| | ←----- % -----→ | | | |
| T1 | 2.48 | 20.3 | 3.15 | 3.24 |
| T2 | 3.17 | 23.1 | 3.86 | 4.37 |
| T3 | 2.93 | 21.7 | 3.72 | 4.17 |
| T4 | 2.63 | 21.0 | 3.46 | 3.51 |
| T5 | 2.83 | 21.3 | 3.75 | 3.87 |
| T6 | 2.73 | 22.2 | 3.82 | 3.59 |

36. TITLE NUTRITIONAL QUALITY EVALUATION OF MUNGBEAN GENOTYPES DUE TO MICROBIAL INOCULATION

Objectives To improve the nutritional value of Mung bean through microbial inoculation.
Research Workers Dr. Shakeel Ahmad Anwar and Muhammad Sajjad Saeed
Duration 2019(Continuous)
Location Faisalabad

Treatments Lay out = Split Plot
 Replication = 3
 Plot Size = 4m x1.2 m
 Row spacing = 30cm
 Plant Spacing = 10cm
 Sowing Date =15 June -15 July

Varieties:
 15003, 14005, 15005, 08009, Azri-2006, NM-16

Methodology Recommended doses (25-60 N, P kg/ha) of fertilizer will be applied at sowing. Following Split Plot Design with three replications. One set of treatments will be inoculated with microbial strains while the other remains un-inoculated and treated as control. Data regarding yield and nodulation will be recorded. Samples will be dried, ground and analyzed for crude protein, crude fiber, crude fat and ash etc.

Previous Year's Results

| Name of genotypes | Un-inoculated | | | Inoculated | | |
|-------------------|-----------------------------|-------------------|--|-----------------------------|-------------------|--|
| | Nodules plant ⁻¹ | Plant height (cm) | Secondary branches plant ⁻¹ | Nodules plant ⁻¹ | Plant height (cm) | Secondary branches plant ⁻¹ |
| 15003 | 13.6 | 36.7 | 3.5 | 16.2 | 44.1 | 4.3 |
| 14005 | 14.5 | 43.5 | 3.9 | 17.5 | 59.4 | 4.8 |
| 15005 | 14.3 | 33.5 | 3.4 | 18.7 | 47.3 | 3.9 |
| 08009 | 14.4 | 33.7 | 3.5 | 18.9 | 40.2 | 3.7 |
| AZRI-2006 | 15.1 | 33.5 | 3.6 | 18.7 | 42.0 | 4.0 |
| NM-16 | 15.4 | 33.1 | 2.9 | 20.2 | 38.8 | 3.4 |

| genotypes | Pods Plant ⁻¹ | 1000 grain weight (g) | Grain yield (kg ha ⁻¹) | Pods Plant ⁻¹ | 1000 grain weight (g) | Grain yield (kg ha ⁻¹) |
|-----------|--------------------------|-----------------------|------------------------------------|--------------------------|-----------------------|------------------------------------|
| 15003 | 8.9 | 39.03 | 2007 | 11.1 | 42.50 | 2382 |
| 14005 | 8.8 | 40.41 | 1410 | 11.8 | 42.53 | 1931 |
| 15005 | 10.8 | 39.42 | 1694 | 15.1 | 41.47 | 1993 |
| 08009 | 15.3 | 46.97 | 2201 | 21.5 | 48.80 | 2930 |
| AZRI-2006 | 15.5 | 41.49 | 2090 | 19.1 | 43.45 | 2777 |
| NM-16 | 7.9 | 53.56 | 1833 | 9.8 | 55.87 | 2097 |

| Name of genotypes | Un-inoculated | | | Inoculated | | |
|-------------------|--------------------------|-----------------------|------------------------------------|--------------------------|-----------------------|------------------------------------|
| | Pods Plant ⁻¹ | 1000 grain weight (g) | Grain yield (kg ha ⁻¹) | Pods Plant ⁻¹ | 1000 grain weight (g) | Grain yield (kg ha ⁻¹) |
| 15003 | 7.8 | 38.98 | 1544.7 | 10.1 | 41.08 | 1563.5 |
| 14005 | 7.6 | 40.17 | 1319.4 | 11.3 | 43.05 | 1544.7 |
| 15005 | 9.7 | 38.93 | 1466.9 | 14.4 | 41.64 | 1563.9 |
| 08009 | 14.2 | 44.05 | 1696.2 | 16.9 | 46.23 | 1831.8 |
| AZRI-2006 | 15.3 | 41.06 | 1653.4 | 18.0 | 43.37 | 1739.6 |
| NM-16 | 7.6 | 48.63 | 1470.1 | 9.7 | 52.00 | 1599.1 |

| Name of genotypes | Un-inoculated | | | | Inoculated | | | |
|-------------------|---------------|-------------------|---------------|-----------------|------------|-------------------|---------------|-----------------|
| | Ash (%) | Crude Protein (%) | Crude Fat (%) | Crude Fiber (%) | Ash (%) | Crude Protein (%) | Crude Fat (%) | Crude Fiber (%) |
| 15003 | 3.52 | 22.71 | 1.03 | 3.88 | 3.91 | 23.90 | 1.30 | 4.88 |
| 14005 | 3.68 | 23.01 | 1.10 | 3.75 | 4.00 | 24.68 | 1.28 | 4.23 |
| 15005 | 3.53 | 23.32 | 1.15 | 4.12 | 3.84 | 24.30 | 1.23 | 4.74 |
| 08009 | 3.64 | 23.47 | 1.22 | 4.44 | 4.08 | 24.11 | 1.39 | 5.05 |
| AZRI-2006 | 3.74 | 23.66 | 1.13 | 3.97 | 4.12 | 24.23 | 1.25 | 4.52 |
| NM-16 | 3.61 | 23.50 | 1.19 | 3.90 | 3.95 | 24.15 | 1.27 | 4.26 |

37. TITLE NUTRITIONAL QUALITY EVALUATION OF MASH GENOTYPES DUE TO MICROBIAL INOCULATION

Objectives To improve the nutritional value of mash through microbial inoculation

Research Workers Dr. Shakeel Ahmad Anwar, Amer Hussain and Muhammad Shafiq

Duration 2019(Continuous)

Location Faisalabad

Treatments/
 Lay out = Split Plot
 Replication = 3
 Plot Size = 4m x1.2 m
 Row spacing = 30cm
 Plant Spacing = 10cm

Sowing Date = 15 June -15 July

Varieties:

15 M 002, 15 M004, 15 M 001, 15 M008

Mash 97, Arooj 2011

Methodology

Recommended doses (25-60 N, P kg/ha) of fertilizer will be applied at sowing. Following Split Plot Design with three replications. One set of treatments will be inoculated with microbial strains while the other remains un-inoculated and treated as control. Data regarding yield and nodulation will be recorded. Samples will be dried, ground and analyzed for crude protein, crude fiber, crude fat and ash etc.

Previous Year's Results

| Name of genotypes | Un-inoculated | | | Inoculated | | |
|-------------------|-----------------------------|-----------------------|------------------------------------|-----------------------------|-----------------------|------------------------------------|
| | Nodules plant ⁻¹ | 1000 grain weight (g) | Grain yield (kg ha ⁻¹) | Nodules plant ⁻¹ | 1000 grain weight (g) | Grain yield (kg ha ⁻¹) |
| 15 M 001 | 16.9 | 41.2 | 812.5 | 26.1 | 42.2 | 928.4 |
| 15 M 002 | 16.6 | 45.1 | 967.4 | 25.7 | 48.1 | 991.9 |
| 15 M 004 | 17.0 | 43.7 | 897.2 | 27.3 | 45.9 | 936.6 |
| 15 M 008 | 16.3 | 40.2 | 865.3 | 26.3 | 43.1 | 903.9 |
| Mash 97 | 17.5 | 43.4 | 970.5 | 26.7 | 46.1 | 1003.6 |
| Arooj2011 | 22.0 | 42.8 | 992.3 | 28.4 | 45.6 | 1073.7 |

| Name of genotypes | Un-inoculated | | | | Inoculated | | | |
|-------------------|---------------|-------------------|---------------|-----------------|------------|-------------------|---------------|-----------------|
| | Ash (%) | Crude Protein (%) | Crude Fat (%) | Crude Fiber (%) | Ash (%) | Crude Protein (%) | Crude Fat (%) | Crude Fiber (%) |
| 15 M 001 | 3.34 | 22.21 | 1.00 | 3.46 | 3.96 | 23.38 | 1.22 | 3.79 |
| 15 M 002 | 3.33 | 21.87 | 1.15 | 3.28 | 3.60 | 23.49 | 1.22 | 3.56 |
| 15 M 004 | 3.36 | 22.64 | 1.17 | 3.32 | 3.69 | 24.55 | 1.24 | 3.65 |
| 15 M 008 | 3.50 | 23.01 | 1.05 | 3.56 | 3.85 | 24.89 | 1.20 | 4.03 |
| Mash 97 | 3.69 | 22.51 | 1.03 | 3.51 | 3.80 | 23.31 | 1.23 | 3.81 |
| Arooj 2011 | 3.39 | 21.93 | 1.07 | 3.54 | 4.05 | 23.65 | 1.23 | 3.86 |

38. TITLE BIOFORTIFICATION OF MUNG BY ZINC AND IRON APPLICATION

Objectives Zinc (Zn) and Iron (Fe) deficiencies has been reported in our soils which lead to malnutrition. Therefore, this study is planned to increase the Zn and Fe

concentration in pulse crops.

Research Workers Dr. Shakeel Ahmad Anwar, Muhammad Sajjad Saeed and Muhammad Shafiq

Duration 2018-2021

Location Faisalabad

Treatments

T1 = Control (25-60-0)
 T2 = 2.5 kg Zn/ ha
 T3 = 5.0 kg Zn / ha
 T4 = 2.5 kg Fe/ ha
 T5 = 5.0 kg Fe / ha
 T6 = 2.5 kg Zn + 2.5 kg Fe/ ha
 T7 = 5 kg Zn + 5 kg Fe/ ha
 T8 = 0.1 % Zn (Two sprays: one at flowering and one 15 days after first spray)
 T9 = 0.1 % Fe (Two sprays: one at flowering & one 15 days after first spray)
 T10 = 0.1 % Zn +0.1 % Fe (Two sprays: one at flowering and one 15 days after first spray)

Variety: = PRI-Mung 2018
 Layout: = RCBD
 Treatments: = 10
 Replication: = 3
 Plot size: = 4m x 1.2 m
 Row spacing: = 30cm
 Plant spacing: = 10 cm
 Sowing date: = 15 June -15 July

Recommended dose (25-60 N, P kg/ha) of fertilizers will be added to the soil prior to sowing. Data for Plant height, No. of branches, No. of pods per plant, 1000 grain weight and grain yield will be recorded. Pre sowing and post-harvest soil analysis for Zn, Fe, P,K and Organic matter will be carried out

PREVIOUS YEAR'S RESULTS

| Treatments | Number of nodules/ plant | | | | | |
|------------|-------------------------------|-------|-------|-------|-------|-------|
| | Name of genotypes (Mung bean) | | | | | |
| | Azri-2006 | 14005 | 14009 | 15001 | 15004 | 15005 |
| T1 | 14.3 | 15.3 | 15.0 | 14.6 | 14.6 | 15.3 |

| | | | | | | |
|-----|------|------|------|------|------|------|
| T2 | 15.9 | 17.8 | 17.3 | 16.5 | 17.2 | 16.7 |
| T3 | 18.0 | 18.1 | 18.0 | 19.0 | 18.5 | 17.4 |
| T4 | 17.2 | 16.5 | 17.0 | 17.5 | 17.2 | 17.5 |
| T5 | 17.9 | 17.4 | 18.2 | 17.2 | 17.9 | 16.8 |
| T6 | 17.3 | 17.0 | 17.9 | 17.4 | 17.2 | 17.2 |
| T7 | 19.0 | 20.2 | 20.2 | 20.5 | 20.9 | 21.3 |
| T8 | 18.4 | 17.2 | 16.6 | 18.2 | 17.4 | 18.4 |
| T9 | 17.1 | 16.9 | 17.4 | 17.5 | 18.2 | 17.6 |
| T10 | 19.0 | 17.3 | 17.3 | 18.7 | 19.2 | 19.3 |

| Treatments | Grain yield (kg/ha) | | | | | |
|------------|-------------------------------|--------|--------|--------|--------|--------|
| | Name of genotypes (Mung bean) | | | | | |
| | Azri-2006 | 14005 | 14009 | 15001 | 15004 | 15005 |
| T1 | 1327.1 | 1215.6 | 1217.2 | 1275.3 | 1215.5 | 1211.9 |
| T2 | 1427.1 | 1358.6 | 1413.9 | 1438.9 | 1393.6 | 1343.8 |
| T3 | 1505.2 | 1478.5 | 1477.1 | 1473.4 | 1420.4 | 1443.6 |
| T4 | 1453.9 | 1409.0 | 1414.0 | 1433.6 | 1447.0 | 1408.6 |
| T5 | 1480.2 | 1445.2 | 1433.8 | 1440.5 | 1430.0 | 1440.6 |
| T6 | 1439.8 | 1427.0 | 1427.4 | 1446.7 | 1448.6 | 1446.7 |
| T7 | 1625.4 | 1514.5 | 1500.2 | 1571.8 | 1595.1 | 1546.9 |
| T8 | 1445.5 | 1431.1 | 1432.1 | 1463.7 | 1423.5 | 1425.1 |
| T9 | 1443.5 | 1415.5 | 1398.9 | 1476.9 | 1425.3 | 1426.9 |
| T10 | 1482.2 | 1427.8 | 1425.2 | 1427.1 | 1456.9 | 1471.9 |

| Treatments | 1000 Grain weight (g) | | | | | |
|------------|--------------------------------|-------|-------|-------|-------|-------|
| | Name of genotypes (Mung bean) | | | | | |
| | Azri-2006 | 14005 | 14009 | 15001 | 15004 | 15005 |
| T1 | 41.23 | 40.40 | 39.29 | 42.49 | 42.42 | 38.41 |
| T2 | 42.15 | 41.73 | 41.31 | 43.14 | 43.13 | 39.48 |
| T3 | 42.62 | 42.57 | 42.08 | 44.42 | 44.45 | 40.27 |
| T4 | 42.08 | 41.97 | 42.00 | 44.17 | 44.20 | 40.78 |
| T5 | 42.38 | 42.53 | 42.02 | 42.23 | 42.27 | 40.15 |
| T6 | 42.30 | 42.23 | 42.37 | 44.88 | 44.35 | 40.38 |
| T7 | 43.40 | 43.07 | 43.13 | 46.04 | 45.66 | 42.03 |
| T8 | 42.12 | 42.16 | 42.18 | 42.21 | 44.12 | 40.55 |
| T9 | 42.18 | 42.41 | 42.34 | 43.13 | 44.23 | 40.92 |
| T10 | 42.23 | 42.34 | 42.15 | 42.37 | 44.19 | 40.46 |

39. TITLE **BIOFORTIFICATION OF MASH BY ZINC AND IRON APPLICATION**

Objectives

Zinc (Zn) and Iron (Fe) deficiencies has been reported in our soils which lead to malnutrition. Therefore, this study is planned to increase the Zn and Fe concentration in pulse crops.

Research Workers

Dr. Shakeel Ahmad Anwar, Muhammad Sajjad Saeed and Muhammad Shafiq

Duration

2018-2021

| | | |
|-------------------|----------------|---|
| Treatments | T1 | = Control (25-60-0) |
| | T2 | = 2.5 kg Zn/ ha |
| | T3 | = 5.0 kg Zn / ha |
| | T4 | = 2.5 kg Fe/ ha |
| | T5 | = 5.0 kg Fe / ha |
| | T6 | = 2.5 kg Zn + 2.5 kg Fe/ ha |
| | T7 | = 5 kg Zn + 5 kg Fe/ ha |
| | T8 | = 0.1 % Zn (Two sprays: one at flowering and one 15 days after first spray) |
| | T9 | = 0.1 % Fe (Two sprays: one at flowering & one 15 days after first spray) |
| | T10 | = 0.1 % Zn +0.1 % Fe (Two sprays: one at flowering and one 15 days after first spray) |
| | Variety: | = Arooj 2011 |
| | Layout: | = RCBD |
| | Treatments: | = 10 |
| | Replication: | = 3 |
| | Plot size: | = 4m x 1.2 m |
| | Row spacing: | = 30cm |
| | Plant spacing: | = 10 cm |
| | Sowing date: | = 15 June -15 July |

Recommended dose (25-60 N, P kg/ha) of fertilizers will be added to the soil prior to sowing. Data for Plant height, No. of branches, No. of pods per plant, 1000 grain weight and grain yield will be recorded. Pre sowing and post-harvest soil analysis for Zn, Fe, P, K and Organic matter will be carried out

PREVIOUS YEAR'S RESULTS

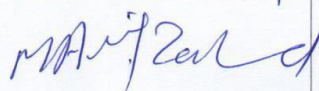

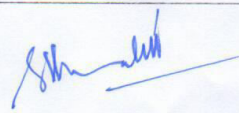
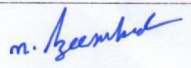

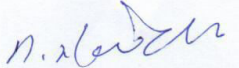
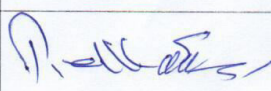
| Treatment | Number of nodules/ plant | | | | | |
|-----------|-------------------------------|---------|---------|---------|---------|---------|
| | Name of genotypes (Mash bean) | | | | | |
| | Arooj-2011 | 16 M003 | 16 M004 | 16 M005 | 16 M006 | 16 M009 |
| T1 | 18.0 | 20.0 | 17.7 | 19.3 | 20.7 | 19.3 |
| T2 | 20.7 | 25.0 | 25.0 | 23.0 | 28.0 | 22.0 |
| T3 | 23.3 | 27.3 | 30.7 | 28.7 | 31.3 | 26.7 |
| T4 | 22.3 | 28.7 | 31.3 | 30.0 | 32.7 | 29.3 |
| T5 | 25.3 | 30.0 | 30.0 | 30.0 | 31.3 | 32.0 |
| T6 | 29.3 | 30.7 | 32.0 | 34.7 | 36.0 | 36.0 |
| T7 | 35.3 | 35.0 | 37.3 | 39.3 | 42.0 | 40.7 |
| T8 | 23.7 | 28.0 | 28.7 | 31.7 | 30.0 | 28.7 |
| T9 | 26.3 | 29.3 | 27.3 | 28.7 | 30.0 | 30.0 |
| T10 | 27.7 | 31.3 | 30.0 | 32.0 | 30.7 | 30.7 |

| Treatment | Grain yield (kg/ha) | | | | | |
|-----------|--------------------------------|---------|---------|---------|---------|---------|
| | Name of genotypes (Mash bean) | | | | | |
| | Arooj-2011 | 16 M003 | 16 M004 | 16 M005 | 16 M006 | 16 M009 |
| T1 | 803.7 | 800.5 | 791.9 | 795.5 | 780.4 | 783.6 |
| T2 | 843.8 | 845.2 | 820.5 | 823.8 | 823.9 | 812.7 |
| T3 | 864.5 | 858.8 | 851.9 | 863.8 | 838.2 | 913.7 |
| T4 | 897.2 | 880.6 | 892.1 | 890.3 | 873.7 | 954.0 |
| T5 | 902.0 | 910.9 | 914.2 | 930.2 | 900.2 | 973.3 |


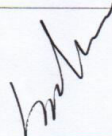
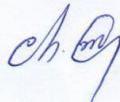
| | | | | | | |
|-----|-------|-------|-------|-------|-------|-------|
| T6 | 975.2 | 971.9 | 956.9 | 972.2 | 942.1 | 990.4 |
| T7 | 975.6 | 980.5 | 980.4 | 995.2 | 970.4 | 991.7 |
| T8 | 904.5 | 923.9 | 900.3 | 948.8 | 933.8 | 879.5 |
| T9 | 913.7 | 911.3 | 896.9 | 935.4 | 945.5 | 900.4 |
| T10 | 899.7 | 865.1 | 908.6 | 948.7 | 920.4 | 900.4 |

| Treatments | 1000 Grain weight (g) | | | | | |
|------------|--------------------------------|----------|----------|--------|--------|---------|
| | Name of genotypes (Mash bean) | | | | | |
| | Arooj-2011 | 16 M 003 | 16 M 004 | 16M005 | 16M006 | 16 M009 |
| T1 | 39.7 | 39.2 | 40.1 | 40.4 | 40.8 | 41.4 |
| T2 | 41.9 | 41.3 | 41.5 | 42.0 | 43.9 | 43.2 |
| T3 | 43.1 | 43.9 | 43.5 | 43.9 | 43.8 | 44.1 |
| T4 | 43.1 | 43.5 | 43.6 | 44.3 | 44.4 | 45.2 |
| T5 | 43.9 | 43.8 | 44.6 | 44.6 | 45.6 | 45.3 |
| T6 | 43.8 | 44.4 | 45.2 | 45.4 | 45.9 | 45.8 |
| T7 | 44.7 | 45.5 | 46.2 | 46.6 | 47.6 | 47.6 |
| T8 | 42.2 | 42.2 | 43.6 | 43.6 | 43.9 | 43.4 |
| T9 | 42.6 | 43.5 | 43.8 | 43.6 | 44.8 | 45.0 |
| T10 | 43.5 | 44.5 | 44.2 | 44.3 | 45.6 | 45.6 |

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