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Overview

Pulses, the major source of vegetable protein, were grown in Punjab on 1050 thousand ha and their production was 415 thousand tones during 2015-16. There are two major pulses production zones in Pakistan. One zone comprising districts of Bhakkar, Khushab, Layyah, Mianwali and Jhang is producing more than 90% chickpea and 80% mung. The other zone comprising Sialkot, Narowal, Chakwal and Rawalpindi districts is producing more than 90% Lentil and Mash. Research on pulse crops was started during 1938 in cereal section. During 1970-71, independent pulses research section was established which was upgraded to Pulses Research Institute, Faisalabad during 1982. Pulses Research Institute has three sub-stations; at Kallurkot (Bhakkar), Rakhuttra (Khushab) and Sahowali (Sialkot). Since its inception Institute has developed 19 varieties of pulses covering 90% area of Punjab and 80% of Pakistan. The institute is internationally recognized as premier institute of Pulses Research in Pakistan. Main objectives of the institute are to evolve pulses varieties with high yield potential, better quality and resistance against biotic (blight, rust, wilt and viruses) and abiotic (drought, cold and heat) stresses and soil disordered. Pulses Research Institute has also developed new promising/advanced lines of different pulse crops which may come up as candidate future varieties. Spot examination of new Mungbean advance line V-08009 was conducted. Advance lines of lentil (V-10502) and dry pea (DP-09-06) are ready for spot examination.

CHICKPEA (Desi) (*Cicer arietinum* L)

Germplasm studies and advancement of breeding material:

Two hundred and eighty one (281) entries at Pulses Research Institute, Faisalabad and Three hundred and seventy five (375) entries at Gram Breeding Research Sub-Station, KallurKot were characterized and maintained in gene pool in order to use them as desirable parents in hybridization scheme.

Twenty seven (27) F₀ and twenty one (21) F₁ crosses were harvested successfully for advancement to F₁ and F₂ generations, respectively. In F₂ generation, Ten (10) cross combinations were harvested for advancement to F₃ generation. More than one thousand (1000) single plant progenies were harvested from F₂ to F₅ generation. Four hundred and ninety (490) progenies were selected for generation

enhancement during the next year. Eight uniform lines from F₅ and twenty eight (28) uniform lines from F₆ were selected for assessing yield potential in preliminary yield trials.



Chickpea Field Trials

Station Yield Trials:

The objective of these trials was to evaluate the promising lines for yield potential and disease tolerance. Two Preliminary Yield Trials (PYT-I & PYT-II) and one Advance Yield Trial were conducted at Pulses Research Institute (PRI) Faisalabad and Gram Breeding Research Sub-Station (GBRSS) Kallurkot. In both of the Preliminary Yield Trials thirty-six (36) entries were evaluated against two check varieties. Entry D-16001 (3170 kg/ha) in PYT Set-I and D-16033 (2866 kg/ha) In PYT Set-II gave overall higher yield than the check Punjab-2008, (2705 kg/ha). Fourteen entries performed better than the check entry on overall yield basis in two trials ranging from 2617-3178 kg/ha.



Director Pulses Visiting Chickpea Crop at Farmer Field

In Advance Yield Trial eight (8) entries performed better than the check entry on overall yield basis. Entry D-15036 (2858 kg/ha) produced the highest grain yield on an average as compared to the Check entry Punjab-2008 (2580 kg/ha).



Cooperative Yield Trial

Adaptation Yield Trials:

A co-operative yield trial was conducted at twelve (12) different agro-ecological locations of Punjab with the collaboration of other sister organizations. PRI contributed 10 advance lines out of 20 entries.

Advance lines D-13036 (2248 kg/ha) and D-13012 (2241 kg/ha) ranked top two positions in Co-operative Yield Trial and out yielded the check Bittal-2016 (2112 kg/ha).

National Uniform Yield Trial:

This institute contributed five advance lines in the National Uniform Yield Trials (NUYT) 2016-17 to test their performance at different ecological zones. Neither entry could surpass the two check varieties i.e. Punjab-2008 and Bittal-2016.

High Input responsive genotypes Trial:

An experiment comprising of eighteen (18) genotypes (desi and kabuli) was conducted to evaluate their response to different fertilizer applications. All the entries except entry D-075-09 showed higher yield with fertilizer application of one bag of DAP and One of Potash. Entry D-13022 (2111kg/ha) gave the highest yield with this fertilizer application.



High Input responsive genotypes Trial

Single Plant Selection from Farmers Field:

More than one hundred single plant selections were made from farmer's fields of Thall area. These selections will be sown and evaluated during 2017-18

Seed production:

A total of 8645 kg pre-basic and basic seed of chickpea Desi varieties Punjab 2008 (5600 kg) and Bittal-2016 (3045 kg) was produced.



Seed Production of Bittal 2016.S

CHICKPEA Kabuli (*Cicer arietinum* L.)

Performance of New Chickpea Kabuli Advance Lines at National Level:

Three chickpea kabuli advance lines were contributed in NUYT which was conducted on 10 locations in different ecological zones of Pakistan. On the basis of pooled data, entry K-01216 contributed by Pulses Research Institute, Faisalabad, got 1st position with 2275 kg/ha grain yield. Entry K002-10, contributed by this institute under PARB project 120, got 2nd position with 2259 kg/ha grain yield.



K-01216

Germplasm Studies and Advancement of Breeding Material:

Three hundred (300) germplasm entries were characterized and maintained in order to find

desirable parents for utilization in hybridization scheme. Twenty three (23) F₀ and sixteen (16) F₁ crosses were harvested successfully for advancement to F₁ & F₂ generations, respectively. In F₂ generation, 34 single plant progenies were selected from nine (9) cross combinations studied. Likewise in F₃ generation, one hundred and thirty-four (134) single plant progenies were selected out of twenty-two (22) cross combinations for generation advancement to F₄ generation. Similarly, in F₄ and F₅ generations, 192 single plant progenies were selected from 270 single plant progenies for generation advancement. From F₆, thirty-two (32) uniform lines were selected from seventy (70) advanced breeding lines for assessing yield potential in preliminary yield trials.

Station Yield Trials:

The objective of these trials was to evaluate the promising lines for yield potential and disease tolerance. In Preliminary Yield Trials (PYT-I & PYT-II) conducted at Pulses Research Institute (PRI) Faisalabad and GBRSS, Kallurkot and Advance Yield Trials (AYT) conducted at PRI, Faisalabad, GBRSS, Kallurkot and PRSS, Rakhuttra, thirty-two (32) and fourteen (14) entries including checks were evaluated, respectively.

Entry K-01610 (2589 kg/ha) in set-I and K-01626 (2500) in set-II gave overall higher yield than better check Noor-2009 (2231 kg/ha) in set-I and (2237 kg/ha) in set-II in Preliminary Yield Trials, respectively. In Advance Yield Trial, entry K-01519 average yield (1854 kg/ha) performed better than the superior check Noor-2009 (1801 kg/ha).

Adaptation Yield Trials:

In Micro Yield Trials conducted at PRI, Faisalabad, GBRSS, Kallurkot, PRSS, Rakhuttra, ARS, Karor and BARS, Fatehjang, five test entries viz. K-01401 (1336 kg/ha), K-01406 (1307 kg/ha), K-01407 (1295 kg/ha), K-01405 (1272 kg/ha), and K-01404 (1270 kg/ha),

overall performed better over superior check, Noor-2009 (1259 kg/ha). In cooperative yield trials conducted at eleven (11) different agro-ecological conditions of Punjab, test entries K-01241 (1660 kg/ha) and K-01308 (1636 kg/ha) occupied first two positions, respectively and out yielded the check, Noor-2013 (1390 kg/ha).



Lentil Advance Line V-10502

Seed Production:

A total of 1181 kg BNS, pre-basic and basic seed of chickpea kabuli varieties, Punjab Noor-2009 and Noor-2013 was produced.

LENTIL (*Lens culinaris* .L)

Germplasm studies:

Lentil Germplasm comprising of 217 lines was maintained, characterized and utilized in hybridization. Days to 50% flowering (72-108), days to maturity (135-160), plant height (20cm - 40cm), 1st pod height (10cm – 23cm), No. of primary branches/plant (6-18), No. of secondary branches/plant (10-26), No. of pods/plant (50-280), No. of seeds/pod (1-2), seed yield/plant (2.5g– 5.0g) and 1000-grain weight (15g- 29g) were recorded.

Hybridization and filial generations:

This study was designed to develop new genotypes and to select recombinants with desirable traits in segregating population. Twenty new cross combinations were successfully harvested for future selection in segregating generations. Whereas 600 single plant progenies

from F₂ to F₆ were evaluated/ selected for future studies.

Preliminary Yield Trial:

In Preliminary yield trial, ten entries including two checks were evaluated. Entries V-16508 and V-16506 gave significantly higher yield (2169 and 1861 kg/ha respectively) than high yielding check Pb.M-2009 (1458 kg/ha).

Advanced Yield Trial:

In Advanced yield trial twelve entries including two checks were evaluated. The lines V-15502 and V-15504 gave higher yield 1233 kg/ha and 1198 kg/ha, respectively than all other entries including the high yielding check Pb.M-2009 which yielded 851 kg/ha.

Micro Yield Trial:

In Micro yield trial ten entries including two checks were evaluated at five different locations. Entries V-14512, V-14513 secured 2nd and 3rd position by yielding 974 kg/ha and 968 kg/ha, respectively than all other entries.



Lentil Yield Trials

Evaluation of Advanced Lines of Lentil against Drought:

Fourteen entries were studied for drought tolerance. Entries were sown in well prepared soaked soil and after sowing no irrigation was applied. Entries V-12512 and V-10502 gave high yield, 1347 kg/ha and 1194 kg/ha respectively.

Seed Production:

1810 Kg seed of Punjab Masoor 2009 (BNS, Pre-basic and Basic) was produced in order to supply seed of approved variety to the public and private sector and seed producing companies to maximize the seed production of lentil in the country

MUNGBEAN (*Vigna radiata* L. Wilczek)**Evaluation of Germplasm:**

Two hundred and seventy (270) entries were maintained and evaluated during Kharif season. On the basis of superiority for different traits, twelve genotypes were selected for hybridization program.

Study of filial generation:

Twenty eight new crosses were attempted however fourteen successful crosses were harvested. Five hundred single plant progenies were selected from F₁ to F₆ generations for future studies.

Preliminary & Advance yield trials:

In preliminary yield trial 09 entries were tested. Five advance lines (15002, 15004, 15007, 15001 and 15005) surpassed the better check; NM-11 with respect to yield. In Advance yield trial, 08 entries were tested at two locations, Faisalabad and Kallurkot. Six entries were crossed with respect to yield than the check Azri M-06.

Micro yield trial:

In micro yield trial 11 entries were tested, out of which 8 entries viz: 13006, 12005, 13001, 130011, 13009, 13002, 13010 and 13004 gave higher yield (1146, 1099, 1091, 1031, 997, 992, 989 and 914kg/ha, respectively than the checks; AZRI-06 and NM-11 (837 and 803 kg/ha) respectively.

Seed production:

150 kilogram pre-basic and 700 kg basic seed of AZRI M-2006 was produced.



Mung advance line V-08009

MASH (*Vigna mungo* L. Wilczek)**Germplasm studies:**

Mash Germplasm comprising of 60 lines was maintained, characterized and utilized in hybridization. Plant height (20 cm -70 cm), No. of pods/plant (11-40), no. of seeds/pod (4-6), 1000 grain weight (25-45 g), yield/plant (2.50-13.80 g), days to flowering (35-50), days to maturity (90-120) and harvest index (6.87-30.32%) were recorded.

Hybridization and study of filial generations:

This study was designed to create variability by making crosses among the elite lines/ cultivars. Ten cross combinations were attempted and 6 successful crosses were harvested for further studies. Whereas 85 single plant progenies from F₂ to F₆ were evaluated/selected for further studies.

Preliminary yield trial:

In Preliminary yield trial twelve entries including check were evaluated at Faisalabad, Entry 16M004 gave significantly higher yield (650 kg/ha) than check Mash-97 (627 kg/ha).

Advanced yield trial:

In Advanced yield trial ten entries including check were evaluated. The check Mash-97 gave higher yield 917 kg/ha than all other entries including line 15M002 which yielded 648 kg/ha.

Micro yield trial:

In Micro yield trial 10 entries including check were evaluated,. Entry 14M003 secured top position by yielding 523 kg/ha followed by 14M005 which yielded 517 kg/ha.

Seed production:

About 120 Kg pre-basic seed of Arooj and 30 Kg of Mash-97 was produced whereas 300 kg basic seed of Arooj and 50 kg basic seed of Mash 97 was produced.

COWPEAS (*Vigna sinensis*)**Testing of advanced lines in yield trials:**

In preliminary yield trial, 7 genotypes gave higher yield than the check SA Dandy (833 kg/ha). Maximum yield was given by CP-058 (1147 Kg/ha). In advance yield trial 7 entries out yielded the check variety S.A. dandy (643 kg/ha). Maximum yield was given by Cp-030 (1067 kg/ha) In micro yield trial 4 entries were tested with the check S.A. Dandy, CP-037 gave higher yield (770 kg/ha) than the check (57 kg/ha).

DRY PEAS (*Pisum sativum* L.)**Maintenance and evaluation of germplasm:**

One hundred and three genotypes of dry peas(*Pisum Sativum* L.) were maintained and evaluated for different characteristics. In hybridization programme, 25 new/fresh crosses were made successfully and Ninety one crosses from F₁ to F₆ were studied.

Preliminary Yield Trial:

Sixteen advanced lines were evaluated, DP-03-13 and DP-12-14 were highest with respect to yield of 2639 kg/ha and 2535 kg/ha respectively. The Check "NO. 267" yielded 1844kg/ha.

Advanced Yield Trial:

In Advance Yield Trial, fourteen advanced lines were evaluated, DP-13-15 and DP-02-15 were highest in yield viz. 2978 kg/ha and 2924 kg/ha respectively. Check had the lowest yield of 1998 kg/ha.

Micro Yield Trial:

In Multi location Yield Trial, Twelve lines were evaluated, DP-01-14 and DP-06-14 were highest in yield viz. 2283 kg/ha and 2258 kg/ha respectively.

New advanced line DP-09-08 completed two years of distinguishing uniformity stability (DUS) Studies.



Mungbean YMV Screening Nursery

PLANT PATHOLOGY

Main emphasis was on screening of breeding material against different diseases of pulses crops under natural as well as under tunnel conditions.

Evaluation of Mungbean (*Vigna radiata* (L.) Wilczek) promising lines/ varieties for tolerance to Mungbean Yellow Mosaic Virus (MYMV) and Urdbean Leaf Crinkle Virus (ULCV)

Each entry was planted in 3 meter long and 0.30 m apart single row during the 1st week of July. Mung Kabuli, highly susceptible to MYMV was sown as spreader after every two test entries. Twenty eight (28) lines/varieties of Mungbean were evaluated against MYMV and ULCV. Thirteen lines (15001, 15002, 15003, 15005, 15007, 15024, 15025, 15029, 15030, VC1968,15141,AZRI-06 and NM-11) were Moderately Resistant and 15 lines were found susceptible against MYMV. Urdbean Leaf Crinkle Virus was not observed on Mungbean lines.

Evaluation of Mash (*Vigna mungo* (L.) Hepper) lines/ varieties for tolerance to Urdbean Leaf Crinkle Virus (ULCV) and Mungbean Yellow Mosaic Virus (MYMV)

During the 1st week of July, each entry was sown in 3 meter long and 0.30 m apart single row replicated thrice. A highly susceptible variety kandhari Mash was sown as spreader after every two test entries. Out of 06 test entries evaluated against MYMV and ULCV, 03 lines (13M001, 15M004 and 15 M005) were Resistant, 02 lines (14M006 and 15M009, were Moderately Resistant and 01 lines (13M001) was found Moderately susceptible against MYMV. Urdbean Leaf Crinkle Virus was not observed on the Mashbean lines.

Evaluation of Cowpeas (*Vigna sinensis*) promising lines for tolerance to Cowpea Yellow Mosaic Virus (CYMV)

Each entry was planted in 3 meter long and 30cm apart single row during the 1st week of July.. A highly susceptible Desi Arvan was sown after every two test entries as spreader. Thirteen test lines were evaluated against CYMV and all the lines were found highly resistant.



Cowpea Yellow Mosaic Virus screening



Mash bean screening lines against MYMV

Evaluation of Mungbean (*Vigna radiata* (L.)Wilczek) lines for resistance / tolerance to Cercospora leaf spot

Each entry was planted in 3 meter long and 30cm apart single row during the 1st week of July in two replications. A highly susceptible variety C₂-94-4-36 was sown after every two test entries. Out of 66 lines/varieties, no line was Resistant however 12 lines were found Moderately susceptible and 54 were susceptible under controlled conditions.



Eye Shaped Spot of Blight on Leaves & Pods

Chickpea lines/ varieties against Wilt/ Root Rot diseases

The trial was sown in 3m × 0.30 m plot with 3 replications. AUG 424 was sown as check entry which was repeated after every 2 lines. Two hundred and twenty six chickpea lines/ varieties were screened out against root rot complex in a sick bed Out of 226 lines/ varieties, 8 lines (Noor 13, K-01501, K-01504, K-01509, BRC-

457, K-01406, K-01417 and K-01424) and 5 lines (K-01605, K-01606, K-01609, K-01610 and K-01618 were moderately resistant. Root rot symptoms



Chickpea wilt screening nursery

Screening of lentil germplasm against wilt and root rot diseases

The trial was sown in 3m × 0.30 m plot with 3 replications. M-85 was sown as check entry which was repeated after every 2 lines. Out of 51 germplasm lines, evaluated against root rot diseases, nine lines (V-11501, V-12505, V-13502, V-13514, V-13516, V-14502, V-145132, V-14515 and V-15512) were found resistant.

Screening of lentil germplasm against lentil rust (*Uromyces viciae-fabae* Pers.)

This trial was conducted at Adaptive Research Farm Kot Naina, Teh. Shakar Gargh. The trial was sown in 3m × 0.30 m plot, M-85 was sown as check entry and repeated after every 6 lines (V-16507, V-16508-V16509, V-16510, V-15504 and M-93 were highly resistant and 13 lines found resistant and 12 were found highly susceptible.



Lentil rust

ENTOMOLOGY

Identification of Chickpea (Kabuli) Advance Lines for tolerance against Pod Borer:-

Ten advance lines of chickpea (01302, 01206, 01219, 01308, 01221, 01241, 01309, 01242, 01240, 01219) were tested against pod borer on at Faisalabad. Layout system was RCBD having three repeats. Plot size was 4m×1.2 m. Pod borer infestation was recorded from 5 randomly selected plants per plot. The line 01302 and 01206 showed moderately resistance against pod infestation having minimum pod infestation 6.00 and 6.75 % respectively.

Identification of Chickpea (Desi) Advance Lines for tolerance against Pod Borer:-

Ten advance lines of chickpea (13034, 013035, 13007, 13004, 13006, 13029, 13011, 13012, 13029, 13031) were tested against pod borer on at Faisalabad. Layout system was RCBD having three repeats. Plot size was 4m×1.2 m. Pod borer infestation was recorded from 5 randomly selected plants per plot. The line 013034 and 13035 showed moderately resistance against pod infestation having minimum pod infestation 5.70 and 6.10 % respectively.

Identification of Lentil Advance Lines for tolerance against Aphid:-

Ten advance lines of lentil (13501, 13517, 13515, 13502, 13506, 13509, 13512, 13505, 13516, 13513) were tested against aphid on at Faisalabad. Layout system was RCBD having three repeats. Plot size was 4m×1.2 m. Aphids population was recorded from 20 randomly selected branches per plot. The minimum population 0.50 and 0.60 aphids per branch were in lentil line 13501 and 13517 respectively.

Efficiency of some insecticides against white fly on mung crop:

Four insecticides and their combinations i.e. (Acetamaprid 20sp, Pyriproxifen 10.8EL, Niten Pyrimur 10%SC, Imedacloprid 200L,

Acetamaprid 20sp + Pyriproxifen 10.8EL, Pyriproxifen 10.8EL + Imedacloprid 200SL, Pyriproxifen 10.8EL + Niten pyirum 10%SC) were applied against whitefly on mung crop at Faisalabad. Layout system was RCBD having three repeats. Plot size was kept 10 m X 3 m. Whitefly population on per leaf basis was recorded 3 and 7 days after spray from 15 randomly selected leaves of 15 plants from each plot. The combination of Acetamaprid 20sp + Pyriproxifen provide the excellent results against the white fly i.e. 85.63 % mortality after 3 days and 87.96% after 7 days.

BACTERIOLOGY

Use of Rhizobium and PGPR Co-inoculation for chick pea production

The trial was conducted to identify the best suited Rhizobium - PGPR co inoculation for optimum Chickpea production. Treatments viz control (25-60-0) T₁, Rhizobium specie of chickpea (T₂), Azotobacter (PGPR₁) T₃ and bacillus (PGPR₂) T₄, Rhizobium + PGPR₁ (T₅) and Rhizobium + PGPR₂ (T₆) were maintained. Rhizobium specie of chickpea (T₂) gave highest yield (1761 kg/ha).



Meeting of Research & Development Board

ONGOING PROJECTS

1. PARB PROJECTS-532

Development of Short Duration, high yielding and disease resistant mungbean cultivars in Rice-Wheat Cropping system.

PUBLICATIONS

Naveed M, Ahsan M, Akram HM, Aslam M and Ahmed N (2016) Measurement of cell membrane thermo-stability and leaf temperature for heat tolerance in maize (*Zea mays* L.): Genotypic variability and inheritance pattern. *Maydica* 61(2): 1-7. **IF [0.534]**

Khan NH, Ahsan M, Naveed M, Sadaqat HA and Javed I (2016) Genetics of drought tolerance at seedling and maturity stages in *Zea mays* L. *Spanish Journal of Agricultural Research* 14(3): 1-11. doi.org/10.5424/sjar/2016143-8505. **IF [0.760]**

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