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OVER VIEW

Arid Zone (Thal region) is contributing 88% chickpea, 84% mungbean, 95% guar and 14% wheat production of the Punjab. Total area of thal region is about 3.5 mha, which comprises the districts of Khushab, Mianwali, Jhang (Partly), Bhakkar, Layyah and Muzaffargarh. Arid zone area is characterized with harsh climatic conditions, poor sandy soil and erratic rainfall. Gram is primarily grown in rainfed agriculture system on marginal lands where other crops cannot be grown profitably while mungbean is predominantly grown in irrigated agriculture. The major supply of pulses depends upon the production of chickpea and mungbean, failure of these crops results in the pulses debacle in the country. Sowing of chickpea crop in Thal largely depends on availability of moisture at the time of planting. Mandate of Arid Zone Research Institute, Bhakkar is to develop high yielding, temperature and drought tolerant varieties, integrated pest and disease management and provision of quality seed to progressive farmers and other seed multiplying agencies. A new high yielding and disease resistant wheat variety Fakhar-e- Bhakkar was developed and got approved for general cultivation from Punjab Seed Council. Similarly two new high yielding, disease & heat tolerant mungbean candidate varieties were developed and got cleared by experts in spot examination.

CROP BREEDING

PULSES:

A. CHICKPEA:

Hybridization

Hybridization program was carried out for the development of desirable recombinants and their evaluation in filial generations. Eight crosses were attempted. Seed of six successful crosses was reserved to raise F_1 generation during next crop season. Filial generation (F_1 to F_7) comprising 886 populations were studied and 210 single plant progenies were selected on the basis of visual observations to good agronomic traits, diseases and insect pest resistance. Twenty seven uniform lines were selected

from F_7 for further evaluation in preliminary yield trials.



Field view of gram hybridization

Preliminary Yield Trial

Fourteen entries were evaluated in preliminary yield trials against standard check varieties Bittal-2016 & Bhakar-2011 in RCBD. The plot size was maintained as 4 x

1.2 m. Data regarding germination %age, days to 50% flowering, number of pods per plant, 100 grain weight, days to maturity, disease incidence (Ascochyta blight & wilt) and grain yield were recorded. Two lines only surpassed check varieties. The strain TG1617 gave the highest yield (2201 kg/ha), followed by TG1614 with the yield of 2089 kg/ha. However, check varieties Bhakkar-2011 & Bittal-2016 gave the yield of 1732 and 1560 kg/ha, respectively.



Supplement irrigation with rain gun to gram during prolong drought spell

Regular Yield Trial (Desi & Kabuli)

Sixteen test entries were studied in regular yield trials (Desi & kabuli) against the standard check varieties Bhakkar 2011, Bittal-2016, Noor-2009 and Noor-2013. The plot size maintained as 4 x 1.2m. Data regarding yield and other yield parameters were recorded. Seven lines out yielded the check entries Bhakkar-2011 & Bittal-2016 in brown chickpea trial. Genotype TG1507 gave the highest yield (1335 kg/ha) followed by TG1504 and TG1509 with yield of 1160 and 1021 kg/ha, respectively. Two check varieties Bhakkar-2011 and Bittal-2016 gave the yield of 927 and 701 kg/ha, respectively. However, in kabuli type trial three entries excelled check variety and the test entry TGK1504 gave the highest yield 1313 kg/ha followed by TGK1506 with the yield of 1285 kg/ha. Approved varieties Noor-2013 &

Noor-2009 gave the yield of 1208 and 1113 kg/ha, respectively.



Field view of gram replicated trials

Micro Yield Trial (Desi)

Ten test entries and two checks were evaluated in micro yield trial at two locations. The plot size was maintained as 5 x 1.2m. The data regarding yield and other requisite parameters were recorded. Test entry TG1426 gave the highest yield 2539 kg / ha in comparison with the check variety Bhakkar-2011 having grain yield 2165 kg / ha.

Cooperative Yield Trial (Kabuli)

Chickpea cooperative yield trial (Kabuli) consisting of 18 entries including standard check Noor-2009 was laid out according to RCBD at AZRI Bhakkar. The entry K-1221 gave the maximum yield of 1498 kg/ha in comparison with check Noor-2013 having grain yield of 515 kg/ ha.

National Uniform Yield Trial (Desi & Kabuli)

Chickpea trial consisting of 26 entries (Desi) was laid out according to RCBD. Four advance lines TGX228, TG1221, TG1218 and TGX-220 were contributed by this institute in NUYT (Desi) 2016-17. TGX228 and TG12121 surpassed the check varieties Bittal-2016 and Punjab-2008. TGX228 gave the yield of 3056 kg/ha and 2544 kg/ha respectively. However, the check varieties

Bittal-2016 and Punjab -2008 gave the yield of 2458 and 2324 kg/ha, respectively. Three advance lines TG12K07, TG12K01 & BKK-02174 were contributed by this institute in NUYT-2016-17 (Kabuli). TG12K07 gave the maximum yield of 3132 kg/ha followed by TG12K01 with yield of 2889 kg/ha against standard check Noor-2013 having yield of 2667 kg/ha.

B. MUNGBEAN:

Hybridization

Hybridization program was carried out to create genetic variability for evaluation of recombinants by testing in filial generations. Ten crosses were attempted. F₀ seed of five successful crosses was reserved to raise F₁ generations in next cropping season. Mungbean segregating generations comprising 143 populations were evaluated in hot irrigated dry climate. One hundred and forty six single plants progenies were selected from F₃ to F₆ generations on the basis of plant structure, pods per plant, 100 grain weight, insect pest and disease incidence. Thirty uniform lines were selected from F₇ for further evaluation in preliminary yield trials.

Preliminary Yield Trials

Two trials (A-1 & A-2) each comprising of 16 entries including two check varieties NM-2011 and AZRI Mung-2006 were conducted according to RCBD. Fifteen test entries performed better than check varieties. The strain TM-1610 gave the highest yield 2011 kg/ha, followed by TM-1606 with yield of 1987 kg/ha. Two check varieties AZRI Mung-2006 and NM-2011 gave the yield of 1732 and 1687 kg/ha, respectively. Strain TM-1628 gave the highest yield of 2089 kg / ha, followed by TM-1617 with yield of 2021

kg/ha in trial A-2. However, check varieties NM-2011 and AZRI-Mung-2006 gave the yield of 1666 and 1546 kg/ha, respectively.

Regular Yield Trials

Regular yield trial comprising 10 test entries and two check varieties NM-2011 and AZRI-Mung-2006 was conducted according to RCBD. Strain TM1504 gave the highest yield of 2308 kg/ha, followed by TM1503 with yield of 2028 kg/ha. However, check varieties NM-2011 and AZRI-Mung-2006 gave the yield of 1683 and 1462 kg/ha, respectively.



Field view of mungbean replicated trials

Micro Yield Trial

Micro yield trial consisting of twelve entries was laid out at two different locations i.e. AZRI, Bhakkar and GBRS, Kallur Kot. TM-1418 gave the highest yield of 1457 kg/ha, followed by TM1426 with yield 1385 kg/ha. However, check varieties AZRI Mung-2006 and NM-2011 gave the yield of 1326 and 1143 kg/ha, respectively.

National Uniform Yield Trial

National uniform yield trial comprising of 18 entries was laid out according to RCBD. Four mungbean advance line 09TM-11, 12TM-03, 13TM-04 and 13TM-14 were contributed by AZRI Bhakkar. The data regarding grain yield and yield components were recorded. This institute test entries displayed very encouraging results on

overall basis (8 locations) and were placed on top position with respect to grain yield and disease reaction.



Mungbean experts gathering for Spot Examination

WHEAT:

Hybridization & Segregating Generations

Hybridization programme was carried out by crossing different genotypes. One hundred and sixty crosses were attempted and F_0 seed of 126 successful crosses was collected. Eighty two bulk populations were selected from F_1 generation in natural rust epidemic condition on the basis of plant height, desirable plant type, disease tolerance, 1000 grain weight and tolerance to heat, frost and drought. In F_2 generation, forty nine desirable populations were earmarked and 50 ears per entry were selected and bulked to raise F_3 generation. Eleven segregating populations were selected from F_3 generation. However, from F_4 & F_5 generations 62 & 135 desirable single plants were selected respectively. Forty two uniform lines were selected from F_6 on the basis of high yield and disease tolerance for testing in preliminary yield trials.

Preliminary Yield Trials

Three preliminary yield trials (A1, A2 & A3) comprising each 18 test entries and two check varieties (FSD-08 & Jouhar-16) were laid out according to randomized complete

block design with three replications. Data pertaining to plant height, days to 50% heading, desirable plant type, disease resistance, tolerance to heat, frost and drought were recorded. Seven top yielder genotypes viz. TW1614 (5217kg/ha), TW1615 (4790kg/ha), TW1621 (4066kg/ha), TW1609 (3967 kg/ha), TWS1603 (3800kg/ha), TW1617 (3788kg/ha) and TW1608 (3773 kg/ha) were selected from A1 trial for further studies in regular yield trials. Similarly eleven top yielder genotypes viz. TWS1637 (5848 kg/ha), TWS1669 (5268 kg/ha), TWS1672 (5029 kg/ha), TWS1663 (4814 kg/ha), TWS1648 (4551kg/ha), TWS1654 (4436kg/ha), TWS1666 (4243kg/ha), TWS16164 (5656kg/ha), TWS16179 (5113kg/ha), TWS16158 (5071kg/ha) and TWS16126 (5069 kg/ha) were also selected from A2 & A3 trials for further studies in regular wheat yield trials.



Field view of wheat replaced trials

Regular Yield Trial

Three regular yield trials comprising each 18 test entries and two check varieties (FSD-08 & Jouhar-16) were laid out according to randomized complete block design with three replications. The observations pertaining to plant height, days to 50% heading, desirable plant type, compact

spikes, disease resistance, tolerance to heat, frost and drought were recorded at proper growth stages. Three top yielder genotypes viz. TW1509 (5151kg/ha), TWS1564 (5070kg/ha) and TWS1555 (4506kg/ha) were selected from B1 trial for further studies in advance yield trials. Similarly eleven top yielder genotypes viz. TWS15118 (5042kg/ha), TWS15110 (4744kg/ha), TWS15104 (4579kg/ha), TWS15129 (4515kg/ha), TWS15117 (4436kg/ha), TWS15109 (4301kg/ha), TWS15167 (5799kg/ha), TWS15158 (5787kg/ha), TWS15145 (5633kg/ha), TWS15137 (5612kg/ha) and TWS15131 (5501kg/ha) were selected from B2 & B3 trials for further studies.

Wheat Adaptation Trial

Four wheat adaptation yield trial comprising twelve test entries and two check varieties (FSD-08) and (Jouhar-16) were laid out according to RCBD with three replications having plot size 5m x 1.2m during second fortnight of November at three locations in Arid Zone, Four advance lines (TW1432, TWS1578, TWS1579 and TWS1581) were selected for further studies in Punjab uniform wheat yield trial. The entry TWS1550 was top yielder having average grain yield of 4673 kg/ha followed by TWS1581 with grain yield of 4504 kg/ha. The check varieties FSD-08 and Jouhar-16 expressed av. grain yield 4168 and 3895 kg/ha respectively.

Punjab Uniform Wheat Yield Trial

A Punjab uniform wheat yield trial comprising of sixty entries with two replications was conducted at three different locations of arid zone (AZRI Bhakkar, PSC Farm Piplan and ARS Karor) during crop

season 2016-17 as a joint venture with WRI FSD. Trial was laid out according to alpha lattice design with two replications. Four advance lines viz TWS1334, TWS1335, TWS1351 and TWS1355 were got tested in Punjab uniform wheat yield trial. Advance lines TWS1335 (4144 kg/ha), TWS1351 (4129 kg/ha) and TWS1334 (4105 kg/ha) performed better and were placed at 2nd, 3rd and 7th respectively in overall ranking in all Punjab basis (Twenty two locations) in comparison with local (Galaxy-13) and provincial (Jouhar-16) checks.

National Uniform Wheat Yield Trial

A national uniform wheat yield trial comprising sixty entries was laid out according to alpha lattice design with two replications. Grain yield and yield components data were recorded and sent to National Wheat Coordinator NARC Islamabad. Three advance lines of AZRI, Bhakkar viz TWS12245, TWS12464 and TWS12155 were tested in NUWYT 2016-17. Advance lines TWS12245 and TWS12464 performed better and were placed at 7th and 11th positions in overall ranking in Punjab province (Twenty two locations) in comparison with national check Faisalabad-08.



Wheat experts gathering for spot examination

Seed production

Breeder nucleus and pre-basic seed of 60 advance lines and approved varieties of gram, mungbean and wheat was also

produced in various quantities for provision to private and public seed sector to ensure quality seed production..

ENTOMOLOGY: Screening of mungbean lines against Insect pest complex

Ten test entries were evaluated for tolerance against sucking insect pests in comparison with standards check varieties AZRI-2006 and NM-2011. The trial laid out in RCBD. Minimum attack of thrips 10.07 / five inflorescence was observed on TM1408. Minimum attack of white fly was observed on TM 1408 (16.53 / five leaves), similarly, minimum attack of Jassid (7.0 / five leave) was observed on TM1428. However, minimum pod sucking bug (3.0 / five pods) was recorded on TM 1410 and AZRI-06.

Efficacy of Different Insecticides against Pod Sucking Bug In Mungbean

Eight insecticides were tested against pod sucking bug in mungbean crop. Four insecticides viz; Dimethoate 40 EC @ 330 ml / acre, Bifenthrine 10EC @ 330 ml / acre, Imidacloprid 200SL @ 200 ml/acre gave the effective control of the pest.

Effect of planting time on the incidence of insect pests in Mungbean

Two varieties AZRI-06 and NM-11 were sown with split plot design in three replications. Six planting dates at 10 days interval were adopted starting from 05.05.2016. Minimum incidence of insect pest was observed on planting time 15-05-2016.

Evaluation of chickpea advance lines against gram pod borer

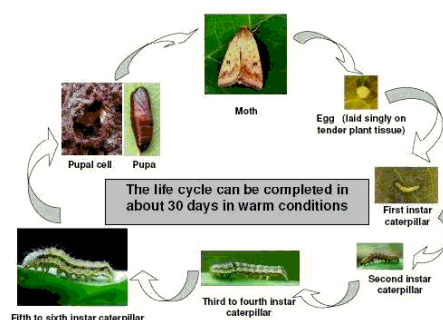
Eleven advance lines were evaluated for gram pod borer tolerance against two check varieties Bhakkar-2011 and Noor-2013. The trail was laid out in RCBD. Less attack of pod borer and pod damaged was recorded in 09AG006, CH16/06, D0097-10, TG1219, Bhakkar-2011 and TG 1219.



Gram Pod borer infestation

Efficacy of different insecticides against gram pod borer

Six insecticides Coral@330 ml/acre, Chloropyrifos 40 EC@ 1000ml /acre, Indoxacarb 150 SC@170ml / acre, Emmamectin benzoate 1.9 EC@200ml /acre, Bifenthrine 10% EC@200ml / acre, Lambda cyhalothrin 2.5 EC@250ml / acre were tested to find out their efficacy against Gram Pod Borer. Minimum number of larvae (3.6 /leaf) were recorded when Lambda cyhalothrine sprayed followed by Indoxacarb (3.8 / leaf) and Emmamectin benzoate (4.0/ leaf).



Screening of wheat genotypes for tolerance against aphid infestation

Fifteen lines of wheat were screened for Aphid infestation. Minimum attack of aphid was recorded on TWS-1581 (148 aphids / 15 tillers) followed TWS-1351 and Ujala-16 with 168 and 200 aphids / 15 tillers, respectively. Similarly, Morocco was found highly susceptible genotype 1187 aphids / 15 tillers.

Management of aphid on wheat using yellow sticky traps

Different number of yellow sticky traps were studied to manage aphids infestation in wheat. Forty yellow sticky traps/acre were

observed to be effective for aphid management.

Effect of planting time and seed rates on aphid population in wheat crop

Six planting dates and five seed were studied for management of aphid infestation in wheat. The variety Fakhar-e-Bhakkar showed the minimum 38.2 aphid / five tillers is comparison with Ujala-2016 with 60.7 aphid / five tillers. Minimum aphid infestation (36.2 aphid / five tillers) when 50 Kg/acre seed was used.

LIST OF SCIENTISTS

1. Dr. Khalid Hussain, Director
2. Dr. Muhammad Aslam, Assistant Botanist
3. Dr. Muhammad Irshad, Assistant Botanist
4. Niaz Hussain, Assistant Research Officer
5. Muhammad Nadeem, Assistant Research Officer
6. Abdul Ghaffar, Assistant Research Officer
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