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ANNUAL ABRIDGE REPORT
FOR THE YEAR
2016-17

OVER VIEW:

Agriculture Research Station was established at Khanpur, District Rahim Yar Khan during the year 1950 to start research work on varietal testing and selection of cereals and coarse grains. It was shifted to Bahawalpur during 1969 and upgraded as Regional Agricultural Research Institute, Bahawalpur during 1987. At this Institute crop breeding efforts are underway to develop comparatively high yielding varieties of wheat, pulses, millet, sorghum and oilseed, suitable for irrigated as well as low rain, arid-climatic zone of Southern Punjab. A number of high yielding, drought-tolerant, disease and insect pest resistant crop varieties alongwith their production and protection technologies have been released for general cultivation in the region. The Institute has been released fourteen wheat including Jouhar-16 & Gold-16, two mungbean, one sorghum, two millet & one raya (Mustard) variety. Hundreds of lines of different crops are in pipeline.

CROP BREEDING DIVISION

ECONOMIC BOTANY SECTION

Wheat (*Triticum aestivum* L.) breeding program at Regional Agricultural Research Institute, Bahawalpur comprises of different experiments focused on wheat problems in southern Punjab viz. hybridization, evaluation of filial generations (F_1 - F_6), and study of exotic material from CIMMYT & ICARDA under local conditions. Yield trials of different categories, viz, Preliminary, Regular, Regional, Punjab and National trials were conducted for evaluating yield performance of wheat advance strains during the year 2015-16.

HYBRIDIZATION

Two hundred and sixty eight entries with diverse nature were sown in two sowing dates. 750 crosses were attempted out of which 424 successful crosses. The purpose of hybridization was to create genetic variability regarding for following characters. The detail of crosses is as under.



Fig.1: Wheat Hybridization

Sr. No	Purpose	No. of crosses	
		Attempted	Successful
1	High yield	260	153

2	Resistance to diseases	150	100
3	Heat and drought	210	105
4	Quality	130	66
Total		750	424

MAINTENANCE OF FILIAL GENERATIONS

(F_1 - F_6)

F_1 to F_6 of wheat studied during the year. 468 families of F_1 were promoted to F_2 for evaluation during 2017-18. A selection of 668, 218, 244, 169 and 284 single plants was made from F_2 , F_3 , F_4 , F_5 and F_6 generation, respectively. These selected single plants will be grown as families in successive generations during the year 2017-18. About 120 families from advanced generations were bulked for further testing in preliminary yield trials in next year. Summary of genotypes in filial generations during 2016-17 is given below,

Sr. No	Gen.	Entries studied	Single plants selected	No. of Entries Bulk
1	F_1	478	-	-
2	F_2	484	668	-
3	F_3	313	218	-
4	F_4	543	244	-
5	F_5	373	169	-
6	F_6	183	284	-

EXOTIC MATERIAL

21 exotic nurseries/trials were evaluated at Regional Agricultural Research Institute, Bahawalpur during the year. Total about 2163 entries studied out of which 316 entries were selected to be used in various yield trials and hybridization programme.

YIELD TRIALS

- 234 entries/varieties were studied in preliminary yield trials (A-trials) under normal as well as late sown conditions. Out of which 31 lines were selected for next regular wheat yield trials (B-trials).
- In B trials, 62 wheat strains were studied during the year excluding commercial checks. Out of which 07 entries have been finalized for testing in RWYT and PUWYT in next year.
- 14 entries were studied in Regional Wheat Yield trials on 07 locations. 03 strains out yielded the best performing check (Galaxy-13 with yield 4654 kg/ha). Out of these better performing strains 02 strains were promoted for testing in PUWYT 2017-18.
- Total 60 wheat genotypes were studied in PUWYT during year. These were tested at 05 locations in Southern Punjab.

There are the following top best performing strains out yielded the best check

Sr.NO.	Genotypes	Average (05 sites-Kg/ha)
1	V-15238	4947
2	V-14270	4625
3	NR-505	4582
4	14B-1572	4560
5	V-14271	4528
(Best Check) Jauhar-16		4070

- National uniform wheat yield trial (NUWYT) consisted of 60 entries which were planted at 07 different locations in Southern Punjab. Best five strains viz:

NW-5-20-1, DN-117, V-14154, DN-126 and AZRC-11 gave highest grain yield 5717, 5629, 5603, 5391 and 5383 respectively.

➤ WHEAT YIELD TRIALS UNDER MOISTURE STRESS

54 entries in five yield trials (A1, A2, A3, A4 and B) were studied under moisture stress conditions. No irrigation except soaking dose was applied to experiments. 26 entries out yielded the check varieties (Galaxy-13 & Jauhar-16).

GENETIC RESISTANCE

- 20 entries were sent to Kenya for screening against Ug-99 (a stem rust race, TTKSK), results are being awaited.
- While 50 advance lines were sent to CDRI, Islamabad for screening against Yellow (Yr) and Leaf rust (Lr), results are being awaited.

SEED PRODUCTION

During the year 3300 kg seed (BNS) of wheat varieties/strains developed at RARI, Bahawalpur was produced.

OILSEED SECTION



Fig. 1, Promising Raya Strain BRJ-1004

Oilseed breeding programme comprised of hybridization, studies of filial generations and yield trials of rapeseed and mustard.

GERMPLASM MAINTENANCE

150 entries of rapeseed and mustard germplasm were studied and maintained for further studies.

HYBRIDIZATION

In hybridization studies, five crosses were found successful in mustard varieties.

FILIAL GENERATIONS

Selection with desired characteristics was made for further evaluation in filial generations (Rapeseed and Mustard). F₁= 04 generations. F₂= 30 single plants were selected F₃= 20 single plants were selected; F₄ = 15, F₅= 10 & F₆=08.

YIELD TRIALS

- Ten varieties/strains of Raya were sown at RARI; Bahawalpur under preliminary yield trial. BRJ-1666 out yielded (2614 Kg/ha) followed by local check line “Bahawalpur Raya” (2189 Kg/ha).
- Ten varieties/stains of Raya were sown under regular yield trial. BRJ-1458 out yielded (2336 Kg/ha) followed by local check line Bahawalpur Raya (2153 Kg/ha).
- Eight varieties/strains of Raya were sown under advance yield trial. BRJ-1451 out yielded as 1639 Kg/ha followed by BWP-Raya (check) as 1239 Kg/ha.
- Thirteen varieties/strains of mustard included in MYT 2016-17 were studied in micro yield trial, one stains, BRJ-1304 yielded 1990 Kg/ha while Super Raya (Check) yielded 1946 Kg/ha. Nine varieties/strains of B. Napus included in MYT 2016-17 were also studied.
- NURYT 2016-17 consisted of 20 entries and NUMYT 2016-17 comprised of 20 entries

were studied at Bahawalpur. BRJ-1004 out yielded by giving 2085 Kg/ha, while Khanpur Raya (check) produced grain yield as 1879 Kg/ha.

PRODUCTION OF PRE-BASIC AND “BNS” SEED

One fifty (150) Kg Pre Basic Seed and 22 Kg “BNS” of “Bahawalpur Raya” was produced at Bahawalpur.

PULSES SECTION

Pulses section conducts research work on Mungbean (*Vigna radiata* L.) and Chickpea (*Cicer aretinum* L.).

• MUNG BEAN

Mungbean breeding programme comprised of germplasm maintenance, hybridization and yield trials.

GERMPLASM MAINTENANCE

51 entries of Mungbean were studied and maintained for future studies.

HYBRIDIZATION

In hybridization studies, 03 crosses were attempted while 02 were found successful.

YIELD TRIALS

Preliminary Yield Trials

A trial consisting of 15 entries selected from local nurseries along with 2 check varieties (CH-M-06 and Azri-M-06) was conducted with 3 replications. The maximum grain yield of 771 Kg/ha was received from BRM-371 which was highest over both check varieties (601 and 617 Kg/ha, respectively).

Advance Yield Trials

A trial consisting of 09 mung lines including

two checks replicated thrice in RCBD was conducted. Two strains (BRM-349 & BRM-366) out yielded both the checks (CH-M-06 and AZRI-M-06) having grain yield of 621 & 671 Kg/ha respectively.

Adaptation Yield Trials

A trial consisting of 06 entries including two checks was evaluated at two locations of Southern Punjab. 3 strains (BRM-356, BRM-364 & BRM-321) had got edge over both checks (NM-92 and Azri-M-06).

National Uniform Yield Trial

A trial consisting of 16 advance mung lines were contributed by the National Coordinator Pulses, NARC, Islamabad. This trial was sown at 15 locations throughout the Pakistan. BRM-353 of this Institute gained 10th position showing grain yield of 632 Kg/ha.

Quality seed production.

The seed of following new strains of mungbean was produced.

BRM-353= 242 Kg

BRM-357= 194 Kg

BRM-311= 223 Kg

• CHICKPEA (*Cicer aretinum* L.)

Chickpea breeding programme comprised of germplasm maintenance, hybridization and yield trials.

GERMPLASM

Germplasm consisted of 80 entries of chickpea. Each entry was sown in an area of 2.4m². Yield ranged from 0.300 to 1.300 Kg/plot.

HYBRIDIZATION

Three crosses were attempted during Rabi-2016-17 and 2 crosses were found

successful. F1 seed from these crosses was collected for raising F1 generation during next season for further evaluation.

FILIAL GENERATIONS

50 entries relating to F1, F2, F3 and F6 generations of desi chickpea were studied. 04 entries from F1, 09 kabuli entries from F2, 12 entries of F3 and 20 entries of F6 with desirable characters were selected for further study during 2017-18.

YIELD TRIALS

Preliminary yield trial of desi chickpea

A trial consisting of 08 entries including 2 Check varieties was sown using RCBD. 05 entries out yielded both the checks (Pb-2008 & BHK-2011 (1751 Kg/ha and 1910 yield Kg/ha).

Preliminary yield trial of Kabuli chickpea

A trial consisting of 05 entries including one Check variety was sown using RCBD. 04 entries out yielded the check variety (CM-2008 =1001 Kg/ha).

Advance yield trial of Desi chickpea

A trial consisting of 10 entries including 2 check varieties was laid out by RCBD fashion. BRC-456 was at top (3542 Kg/ha) regarding grain yield.

Regular yield trial of Desi chickpea

A trial consisted of 07 entries including 2 check (Bhk-2011& Pb-2008) varieties was conducted with three replications. BRC-472 (3081 Kg/ha) exhibited highest yield.

Regular yield trial of Kabuli chickpea

The trial consisted of 05 entries including one check (Cim-2008&Noor-2011) variety

was conducted with three replications having a plot size of 7.2 m². BRC-460 (3192 Kg/ha) was at the top regarding grain yield.

Chickpea adaptation yield trial.

The trial consisted of 06 entries including two checks (Bhk-2011 and Pb-2008) was conducted in RCBD using a plot size of 7.2m². BRC-446 (2734 Kg/ha) was found at the top regarding grain yield.

Chickpea cooperative yield trial (K), Fsd.

A trial consisting of 18 entries were studied having a plot size of 4.8m² in three replications using RCBD. A line Coop-07 showed highest yield (2083 Kg/ha) over all other strains.

Chickpea National Uniform Yield Trial

A trial consisting of 16 advance desi chickpea strains was contributed by the National Coordinator Pulses, NARC, Islamabad. This trial was sown at 15 locations throughout the Pakistan. BRC-390 of this Institute gained 13th position with grain yield of 2195 Kg/ha.

Quality Seed Production

The seed of following new chickpea strains were produced during 2016-17:

BRC- 390	=	185 Kg
BRC-61	=	81 Kg
BRC-408	=	65 Kg

SORGHUM AND MILLET SECTION

Millet and sorghum breeding programme comprised of hybridization, study of filial generations and yield trials of sorghum & millet.

MAINTENANCE OF GERmplasm

44 entries of sorghum and 35 entries of millet for grain purpose were sown and maintained as germplasm.

VARIETAL TRIAL OF SORGHUM

Ten strains/varieties of sorghum were sown in RCBD having 03 replications. Among all strains/varieties RARI-S-22 gave the highest yield as 4194 kg/ha.

VARIETAL TRIAL OF MILLET

In mille (Bajra) varietal trial was conducted using 10 strains/varieties in RCBD having 03 replications, composit-7 gave the highest yield 3450 kg/ha.

VEGETABLE SECTION

Vegetable research program consisted of adoptability trials of winter vegetables and quality seed production of selected vegetables. During this year, adoptability of onion lines were tested under hot climate of Southern Punjab.

COLLECTION AND EVALUATION OF ONION GERmplasm UNDER CLIMATIC CONDITION OF SOUTHERN PUNJAB.

Eleven advance lines/genotypes of onion were collected from VRI, Faisalabad and sown at Bahawalpur. Randomized Complete Block Design was applied with 3 replications and plot size 4.88m×1.52m. Phulkara variety was used as a check. The result indicated that variety Mirpur Khaas (19400 kg/ha) and Robina (17742 kg/ha) out yield all other entries. The same two varieties also exhibited highest av. bulb weight of (77 g) and (71 g) respectively.

SEED PRODUCTION

Quality seed of selected vegetables was produced for supplying to vegetable growers in the region and to refine seed production technology which is essential to maintain genetic purity of the variety. Seed of carrot (cv. T-29) 180 Kg, Radish (cv. Mino) 13 Kg, (cv. 40 days) 325 kg, Turnip (cv. Purple Top) 132 Kg, (cv. Golden Ball) 34 Kg, Onion (cv.

Phulkara) 65 Kg and Okara (cv. Sbz Pari) 85 Kg was produced.

AGRONOMY SECTION

Effect of topping and mepiquate-chloride on the yield of different cotton varieties

The experiment was conducted to know the effect of topping and chemical application (mepiquate chloride) on two cotton varieties i.e. IUB-2013 and BH-178. Topping and spray of mepiquate chloride was done at 4 and 5 feet height. The result revealed that BH-178 performed best with maximum seed cotton yield of 2111 Kg/ha when topping was done at 5 feet height. However, it was statistically at par to mepiquate chloride sprayed at 5 feet height with the seed cotton yield of 2063 Kg/ha. While control produced the minimum.

Efficacy of weedicide and weed control practices in mung bean (*Vigna radiata*)



Fig.1 Trial of Mungbean strain BRM-311

The experiment was designed to evaluate the most efficient weed control method in mung bean crop. Various weedicides i.e. pendimethyline (pre-em), acetachlore (pre-em), lactophin (post-em) and quizlofop p-ethyl (post-em) were applied along with hand weeding. The results revealed that pendimethyline (pre-em) is most effective in controlling weeds with maximum grain yield of 1458 Kg/ha, followed by lactophin (post-em)

with a produce of 1366 Kg/ha. The least results were obtained under control treatment with seed grain yield of 697 Kg/ha.

Effect of spacing on grain yield of sorghum (*Sorghum bicolor* L.)

The experiment was conducted to know the effect of various row spacing on grain yield of locally developed sorghum strain/varieties. One long and one short statured variety was tested at different row spacing. The result showed that the optimum row spacing for obtaining maximum grain yield (1820 Kg/ha) in sorghum crop is 60 cm while the least results (1612 Kg/ha grain yield) were obtained in case of 30 cm row spacing for both varieties.

Effect of spacing on grain yield of newly developed millet strains (Pearl millet)

Two locally developed pearl millet strains were tested under different row spacing to know their effect on the growth and grain yield of millet crop. The crop was planted under various row spacing (30 cm, 45 cm, 60 cm and 75 cm). The maximum grain yield of 1474 Kg/ha was obtained under 75 cm row spacing however it was statistically at par to 60 cm row spacing (1425 Kg/ha) while minimum grain yield of 1235 Kg/ha was obtained in 30 cm row spacing.

Sowing date trial on raya (*Brassica Juncea*)

The experiment was conducted to find the most suitable planting time for the maximum production of locally developed raya strain/varieties i.e. BRJ-9072, BRJ1004, BRJ1103, BRJ-1104, BWP Raya and Khanpur Raya. The results revealed that the

best performing variety was “Khanpur Raya” when sown on 11th October with recorded grain yield of 2593 Kg/ha, whereas the least suitable sowing date for raya was 11 November under Bahawalpur conditions.

Adoption of newly developed wheat strains/varieties to climatic changes under Bahawalpur conditions

The experiment was conducted to evaluate the maximum producing locally developed wheat strains and their adaptation to changing climate scenario of Bahawalpur zone. Seven (7) promising wheat strain/varieties were tested against 8 sowing dates i.e. 1st Nov, 11th Nov, 21st Nov, 1st Dec, 11 Dec, 21st Dec, 1st Jan and 11 Jan. The results revealed that the most suitable sowing time/date for all wheat strains/varieties was 21st of November with maximum mean grain yield of 4935 Kg/ha, however it was statistically at par to 4858 Kg/ha on 1st of December, it is most probably due to pro long of favorable climatic conditions specially temperature during the period. While delay in sowing time reduced the grain yield significantly. As for as the varieties are concerned Aas-11 produced the maximum (4323 Kg/ha), followed by Glaxy-13 with mean grain yield of 4188 Kg/ha.



Fig. 2, Various Wheat Strain/Varieties

Studies on P application method and optimal dose on wheat

The experiment was conducted to evaluate the best possible Phosphorus application method with a suitable dose. The results depicted that the maximum grain yield (4204 Kg/ha) was obtained when phosphorus was placed as band at the rate of 90 Kg per hectare, while broadcast of p fertilizer at 1st irrigation was not suitable for the wheat crop with the minimum grain yield of 3633 Kg/ha.

Response of tall wheat varieties under different moisture regimes in southern Punjab

The experiment was conducted to evaluate the effect of different moisture levels and their application time for tall wheat strains/ varieties developed under local conditions. The results indicate that three irrigations (25, 75 & 115 DAS) are sufficient for producing optimum grain yield in wheat crop. As far as the varieties/strains are concerned, 099172 (Jouhar-16), Aas-11 and Fsd-08 gave maximum mean grain yields of 4680, 4593 & 4581 Kg/ha, respectively, with same irrigation level (3 irrigations).

Studies on planting techniques and varieties in late sown wheat under Bahawalpur conditions

The experiment was laid out to evaluate the performance of various wheat varieties under different planting techniques in late sown condition of Bahawalpur. The results revealed that maximum production was obtained under ridge sowing method followed by line and broadcast sowing. As for as the varieties are concerned Aas-11 produced the maximum

with a mean grain yield of 5085 Kg/ha, however it was statistically at par to Gold-16 with a grain yield of 5001 Kg/ha in ridge planting technique.



Fig. 3, Ridge Planting of Wheat

CHEMISTRY/SOIL SCIENCE DIVISION

IMPACT OF FERTILIZER DOSES ON PROMISING MUNG STRAIN BRM-353 UNDER BAHAWALPUR CONDITIONS

The study was done with the objective to find out the impact of different NPK doses for new Mung cultivar BRM-353. The data collected (Fig.1) revealed that highest yield (1015 Kg/ha) was obtained in T₅ (36-34-25) that was statistically at par with T₃, T₄, T₈, T₁₀ & T₁₁. Results indicate that T₄ (23-34-25) is the best economical dose for this Mung cultivar.

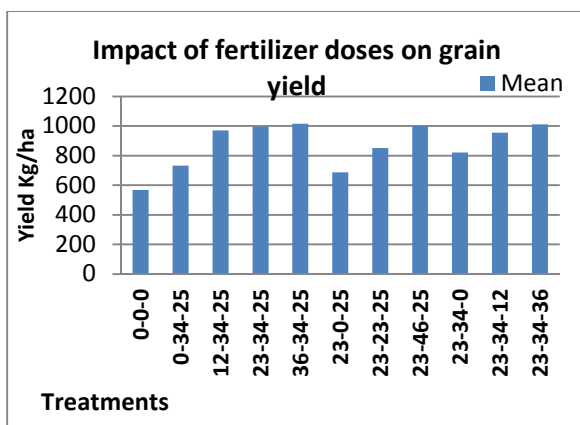


Fig.1: Effect of fertilizer doses on BRM-353

EFFECT OF ORGANIC FERTILIZER ON YIELD OF MUNG BEAN UNDER BAHAWALPUR CONDITIONS

This experiment was conducted with the objective to find out the effect of different doses of Humic Acid on Mung Bean yield. The trial was laid out in RCBD with five treatments. The data collected revealed that highest grain yield (1305 Kg/ha) was obtained in T₅ (23-34-25-20) followed by T₄ (23-34-25-0) with a yield of 1183 Kg/ha and these are statistically at par, so T₄ is the best economical dose for Mung cultivar BRM-374. (Fig.2)

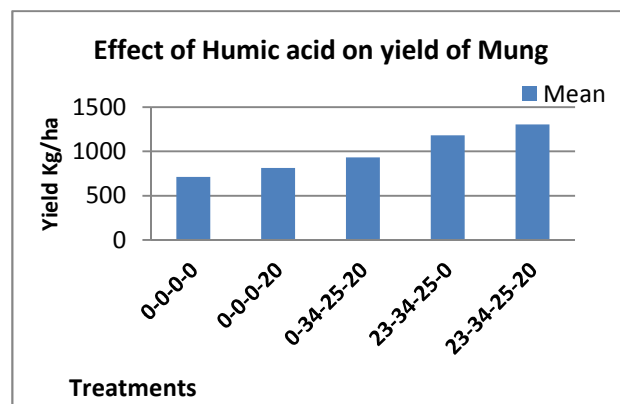


Fig.2: Effect of Humic Acid Mung yield

EFFECT OF SULPHUR COATED UREA ON YIELD OF MUNG

This trial was laid out in RCBD arrangement with eight treatments and three replications with the objective to find out the effect of Sulphur coated urea on the yield of Mung. The results revealed (Fig.3) that the maximum yield (1434 Kg/ha) was obtained in T₆ (23-34-25-0*) which is statistically at par with T₄ and T₈, hence T₄ (23-34-25-0) is the best economical dose for Mung cultivar BRM-353.

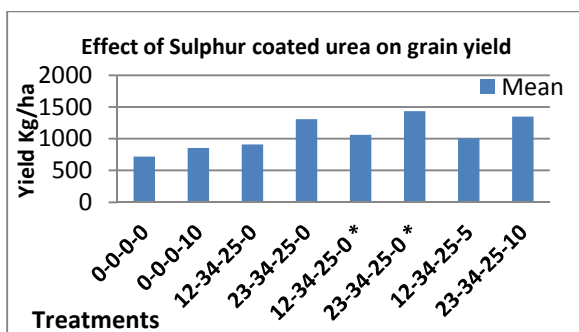


Fig.3: Effect of Sulphur coated urea* on mung Bean

RESPONSE OF MUNG BEAN TO SOIL VS FOLIAR APPLICATION OF BORON

The experiment was conducted to evaluate the response of Soil vs foliar application of Boron to Mung cultivar BRM-357. The RCBD arrangement was followed with eight treatments and three replications. The data collected revealed that T_6 (23-34-25-0.5%B foliar) showed maximum yield of 1066 Kg/ha which was statistically at par with T_2 , T_4 and T_5 . So T_2 (23-34-25-0) is the best economical dose for this Mung cultivar. Fig.4

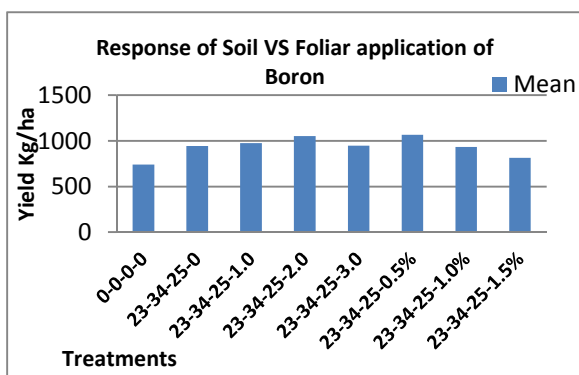


Fig.4: Response of Soil vs Foliar application of boron on Mung

FERTILIZER REQUIREMENT OF NEW MILLET STRAIN RARI COMPOSIT-7 UNDER BAHAWALPUR CONDITIONS

This study was done to finalize most suitable dose of N, P and K for new millet cultivar RARI composite-7. Maximum yield (2204 Kg ha⁻¹) was found in T_{11} (Fig.5) which is statistically at par with T_4 , T_5 & T_8 . Results indicate that T_4 (150-90-60) is the best economical dose.

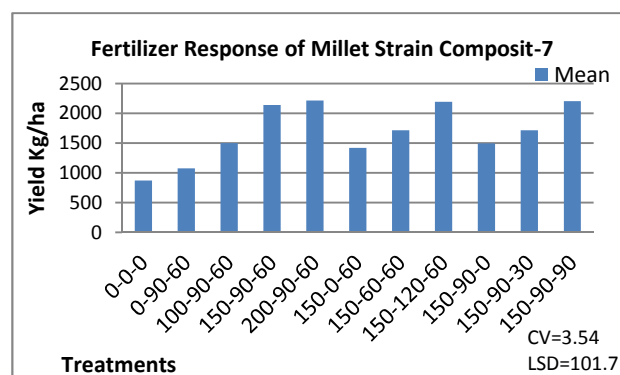


Fig. 5: Fertilizer effect on yield of Millet strain.

RESPONSE CURVE STUDIES FOR NEW SORGHUM RARI-S-5 UNDER BAHAWALPUR CONDITIONS

In this experiment different NPK combinations with 11 treatments were applied to determine the most suitable dose for new sorghum cultivar RARI-S-5 in a RCBD layout. The data revealed that maximum yield (1906 Kg ha⁻¹) was found in T_5 , which is statistically at par with T_4 , T_8 , & T_{11} . The best economical dose for this cultivar is T_4 (150-90-60) Fig.6.

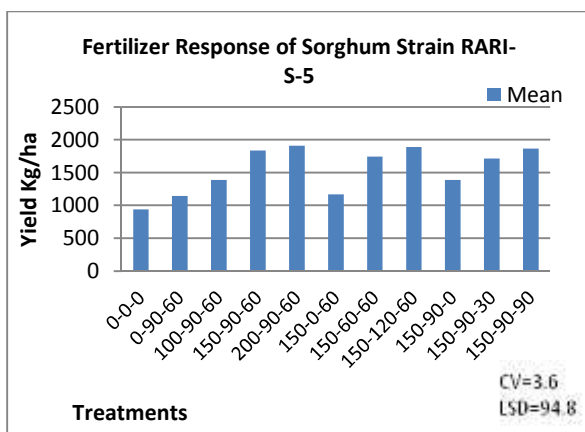


Fig.6: Sorghum Strain RARI-S-5 response to fertilizer.

SCREENING OF WHEAT STRAINS AGAINST SALINITY (HYDROPONIC STUDY) Phase-I)

This experiment was conducted in solution culture to select the resistant wheat strains against salinity. Ten wheat strains were sown in four water tubs having different salinity levels (Fit water, 5, 10 and 15 EC dS/m water). pH of solutions was maintained at 6 - 6.5 on daily basis. Seedling was harvested after 35 days of salinity stress. Results revealed that five strains (15B1116, 15B1131, 2557, 1005 and 2511) performed best under highest salinity (EC 15 dS/m). These strains are selected for phase-II of this experiment (Pots).

Fig.7.



Fig.7: Hydroponic study-I

SCREENING OF WHEAT STRAINS AGAINST SALINITY (Pot Experiment) Phase-II

This experiment was conducted in pots to select the resistant wheat strains against salinity which were selected as best performer (9172, 2809 and FD-08) in hydroponic solution culture experiment conducted during the previous year i.e. 2015-16. Three wheat strains were sown in pots following complete randomized design in three replications and were subjected to four different salinity levels developed in 10 Kg of soil per pot i.e. Fit, 5, 10 and 15 dS/m EC soil. The data recorded revealed that wheat strain 2809 showed best results regarding all growth parameters i.e. plant height, No. of tillers, spike length, total biomass, 1000 grain weight and grain yield, followed by FD-08 and 9172 at highest salinity level i.e. 15 dS/m. Fig.8.

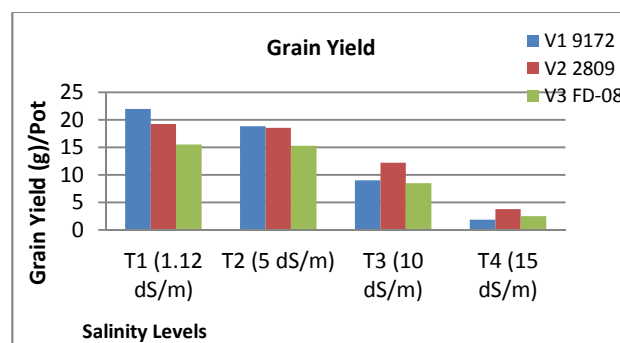


Fig.8: Effect of different salinity levels on wheat strains

FERTILIZER REQUIREMENTS OF PROMISING WHEAT STRAIN UNDER BHAWALPUR CONDITIONS

This study was done to determine the most suitable dose of NPK for new wheat cultivar 122557. According to results of experiment maximum yield 6070 Kg ha⁻¹ was found in T₅

(225-120-60) which is statistically at par with T_4 & T_8 , So T_4 (150-120-60) is the best economical dose with a yield of 5826 Kg ha⁻¹.

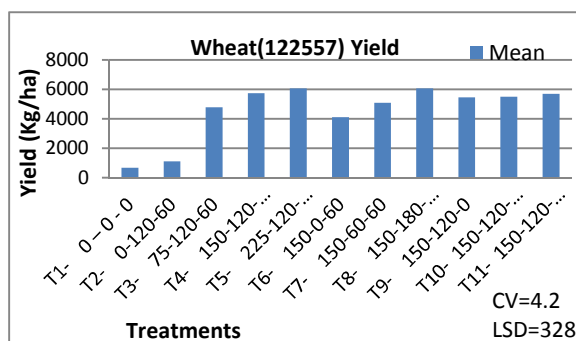


Fig.9: Effect of fertilizer treatments on 2557

RESPONSE OF WHEAT TO SPLIT APPLICATION OF POTASH UNDER BAHAWALPUR CONDITIONS

The experiment was conducted to study the response of split application of potash to wheat. The results of experiment revealed that maximum yield (4923 Kg/ha) was obtained in T_3 ($\frac{1}{2}$ K at sowing + $\frac{1}{2}$ K at ist irrigation) that is at par with all other treatments except control). Hence T_2 (Full K at sowing) or T_3 (Half K at sowing and Half K at ist irrigation) are the best patterns of K application.

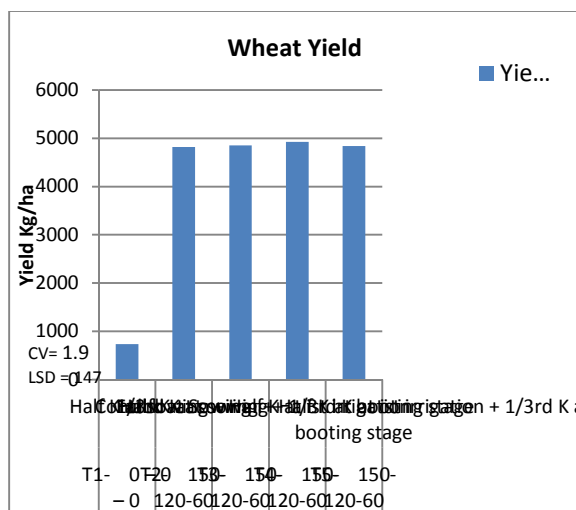


Fig.10: Effect of Split application of K on yield of Wheat

IMPACT OF HUMIC ACID ON GROWTH AND YIELD OF WHEAT

This experiment was laid out to select the best dose of humic acid for wheat under Bahawalpur conditions and its effect on yield and yield components of wheat crop. According to results, maximum yield of 5781 Kg/ha was obtained from T_5 (16 Kg/ha HA) that is at par with T_3 (8 Kg/ha HA) and T_4 (12 Kg/ha HA). So the best dose is T_3 (150-120-60-8 HA) for wheat under Bahawalpur condition.

Fig. 2: : Wheat Strain 076346 response to treatments

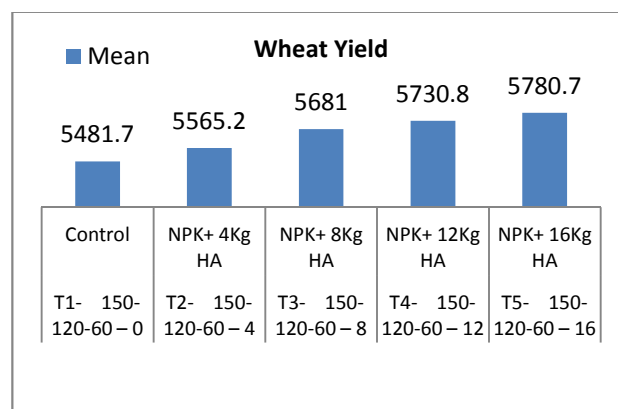


Fig.11: Impact of Humic Acid on yield of wheat

EFFECT OF SULPHUR COATED UREA VS COMMON UREA ON YIELD OF WHEAT

This experiment was done to study the effect of slow release urea vs common urea. For this purpose eight treatments with three replications were designed in a RCBD layout. Results indicate that maximum yield of 5382 Kg/ha was obtained in T_8 (Common Urea + Sulphur) and it is statistically at par with T_4 (Common Urea). So T_4 (150-120-60 Kg/ha) is the recommended dose and form of urea under Bahawalpur conditions.(Fig.12).

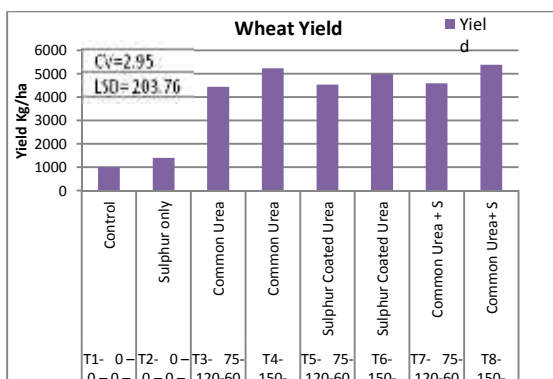


Fig.12: Effect of Sulphur coated vs Common urea on wheat

RESPONSE CURVE STUDIES FOR NEW PROMISING RAYA STRAINS BRJ-9072 AND BRJ-1103 UNDER BAHAWALPUR CONDITIONS

This experiment was done to find a response curve of NPK for Raya crop. Newly evolved Raya strains BRJ-9072 and BRJ-1103 were tested with eleven combinations of NPK. The results of experiment showed that maximum yield of both the strains i.e. BRJ 9072 (1060 Kg/ha) and BRJ 1103(1051 Kg/ha) was found in T₈. However, it is statistically at par with T₄, T₅, & T₁₁. Therefore T₄ (90-60-30) is the best economical dose (Fig. 13).

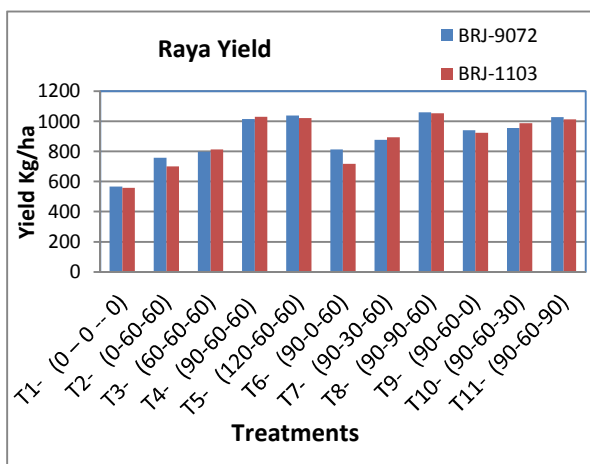


Fig.13: Effect of fertilizer treatments on Raya Strains

PLANT PATHOLOGY SECTION

SCREENING OF WHEAT VARIETIES/LINES AGAINST LEAF RUST

Out of 242 different wheat varieties/lines, 55 were disease free, 20 resistant, 72 moderately resistant, 53 moderately susceptible and 42 susceptible. NARC-11 and Pir Sabak-05 were disease free. Rohtas-90, Punjab-96, Ujala-15 and Gold-16 showed resistant (R), Chakwal-50, Iqbal-00, Uqab-00, and Bakhar-02 exhibit moderately resistant (MR) reaction, Pir-Sabak-04, Johar-16, Aas-11 and Galaxy-13 having moderately susceptible (MS) reaction while Fareed-06, Fsd-08, Lasani-08, , Punjab-11, Inqlab-91, Ufaq-02, Sahar-06, Mairaj-08 and WL-711 expressed susceptible (S) response. Spreader Morocco showed more than 80S response to LR (Fig. 1).



Fig. 1 Leaf rust of Wheat

SCREENING OF WHEAT VARIETIES/LINES AGAINST YELLOW RUST UNDER INOCULATED CONDITION

Out of 242 different wheat varieties/lines, 191 were disease free, 08 resistant, 18 moderately resistant, 16 moderately susceptible and 09 susceptible. BWP-97, Fareed-06, Sahar-06, FSD-08, AARI-11, NARC-11, Pirsabak-04,

Pirsabak-05, WI-711, Ujala-15, Gold-16 and Jauhar-16 remained free from disease, while Inqlab-91, BWP-00, and Uqab-00 were resistance. Punjab-96, MH-97, Derawar-97, Bakhar-02, Shafaq-06 and Galaxy-13 were moderately resistant and remaining i.e. Lasani-08 and Chakwal-50 responded as moderately susceptible reaction. Spreader Morocco showed 100S response to YR. (Fig. 2)



Fig. 2 yellow rust of Wheat

FUNGICIDE DEMONSTRATION FOR REDUCING YIELD LOSS OF WHEAT DUE TO RUSTS.

Sahar-06 was sown as susceptible variety in three treatments (Tilt, Nativo and Control) at 1.5 Acres (0.5 Acres/treatment). Two Rusticides/ Fungicides i.e. Tilt @25ml/15L, and Nativo 75WG @ 15gm/15L were tested against leaf rust. Data revealed that Both the Fungicides (Nativo and Tilt) were found effective against leaf rust infection, Enhanced yield was obtained from all the sites where fungicides were used.

MONITORING OF LEAF BLOTCH (DRESCHSLERA SOROKINIANA) DISEASE ON WHEAT GERMPLASM UNDER NATURAL FIELD CONDITIONS.

242 different wheat varieties/lines were tested against leaf blotch. Out of 242 test entries one forty six (146) entries were found disease free, while fifty three (53) entries showed 1-5 %, Seven (07) showed 6-10%, Twenty (20) showed 11-20%, Fourteen (14) showed 21-40% and Only Two (2) showed >40% disease and categorized according as shown in table below. On spreader check (Bhakar-02) disease was 80%.



Fig. 3 Leaf blotch of wheat

SURVEY FOR DETERMINATION OF KARNAL BUNT, IN WHEAT SEED LOTS GROWN IN SOUTHERN PUNJAB

Thirty one (31) commercial wheat varieties seed samples collected from Desert area farmer's fields of Tehsil Yazman (Bahawalpur), were tested to examine karnal Bunt spores in wheat seed samples on the basis of Soaking method (Wheat seed samples are soaked in 0.2% NaOH solution for 24 h at 20°C.). Out of 31 seed samples, 24 samples were infected and 07 were KB free.

SCREENING OF WHEAT VARIETIES/LINES AGAINST KARNAL BUNT (*Tilletia indica*) UNDER INOCULATED CONDITON

186 different wheat varieties/lines received from Wheat Section Of RARI (78) and

CIMMYT (108) were tested against KB. One hundred and two (102) entries from CIMMYT showed (1R) highly resistant reaction. Six (06) showed 2R reaction. Promising varieties i-e Johar-16, Gold-16, Galaxy-13, AARI-11 and NARC-11 showed resistant (1R) and FSD-08 showed 2R response against karnal bunt of wheat.



Fig. 4 karnal bunt of wheat

SCREENING OF WHEAT VARIETIES/LINES AGAINST LOOSE SMUT OF WHEAT

205 previous year inoculated varieties/lines were sown for loose smut infection. Nine (09) lines were found disease free, One (01) resistant while Ufaq-02, FSD-08, Punjab-11, Millat-11, Pir-Sabak-04 were moderately resistant. Pasban-90, Inqlab-91, MH-97, Punjad-1, Iqbal-00, AS-02, Shafaq-06, Mairaj-08, NARC-11 and TD-1 showed moderately susceptible and Fareed-06, Sahar-06, Lasani-08, AAS-11, AARI-11, Galaxy-13 and WI-711 were susceptible to loose smut.

Fig. 5 Loose smut of wheat



SCREENING OF MUSTARD GERMLASM AGAINST ALTERNARIA BLIGHT (*Alternaria brassicae*), WHITE RUST (*Albugo candida*) and POWDERY MILDEW (*Erysiphe polygoni*).

Among twenty test (NUMYT) entries;

- One (01) entry was moderately resistant, twelve (12) were moderately susceptible and seven (07) were susceptible to Alternaria blight. None of the lines fall in disease free category against Alternaria blight.
- Three (03) entries were moderately resistant, five (05) were moderately susceptible and twelve (12) were susceptible to powdery mildew. None of the lines fall in disease free category against powdery mildew.
- Ten (10) entries were disease free and four (04) entries were highly resistant against White Rust. The remaining were R and MS category against white rust.



Fig. 6 Alternaria blight on brassica

SURVEILLANCE OF WHEAT RUSTS IN SOUTHERN PUNJAB (INCIDENCE AND SEVERITY OF WHEAT DISEASES)

Surveillance was carried out in major districts of southern Punjab. Total 48 sites were visited. Varieties i-e Sahar-06, Galaxy-13, Punjab-11 and TD-01 showed infection of leaf rust. Varieties i-e Sehar-06, Punjab-11, Galaxy-13, AARI-11 and Lasani-08 responded positively against yellow rust. Stem rust was not observed at any site during the year.

SCREENING OF MUNG BEAN CULTIVARS/LINES AGAINST YELLOW MOSAIC VIRUS (MYMV) (Kharif 2016).

14 entries were tested against MYMV. Three entries i-e BRM-350, BRM-364 and NM 2011 showed resistant reaction while three, BRM-345, BRM-349 and BRM-366 showed moderately resistant reaction. Five entries BRM-312, BRM-343, BRM-356 responded as MS and S reaction. While Check, Pigeon pea, BRM-321, and mash bean showed highly susceptible reaction.



Fig. 7 Mung bean yellow mosaic virus

SCREENING OF SORGHUM VARIETIES/LINES AGAINST GRAIN SMUT (*Sphaecelotheca sorghi*). (Kharif 2016)

10 varieties/lines were tested against grain smut disease of sorghum under artificial inoculated condition. One entry YSS-98 was disease free, eight entries PARC-SS1, PARC-SS2, RARI-S3, RARI-S4, RARI-S5, RARI-S10, RARI-S16 and Jowar-86 showed resistant reaction. One entry Jowar-319 was susceptible against grain smut.

ENTOMOLOGY SECTION

SCREENING OF COTTON STRAINS AGAINST INSECT PEST

Twenty one cotton genotypes were screened against sucking and bollworm pests, having layout RCBD. Maximum population of jassid 7.07 per leaf, (Fig-1). whitefly 20.33 per leaf and thrips 14.6 per leaf were recorded on strain Cyto-179, VH-363 and Strain Cyto-178 respectively. The %age damage of pink bollworm was found 62% on cotton strain SLH-15.



Fig. 1, Jassid attack on cotton

EVALUATION OF QUANTITATIVE LOSSES OF COTTON CROP CAUSED BY INSECT PESTS

Two sets of four varieties were sown separately. One set was kept free from attack of insect pest by applying insecticides. In the other set, crop was kept unsprayed to develop the insect pest population.

The yield of treated and untreated plots showed that yield losses ranged from 65%-69%, maximum losses of yield was observed on RH-651 i.e. 69%.

EVALUATION OF VARIOUS STRAINS/VARIETIES OF MUNG AGAINST WHITE FLY UNDER NON SPRAYED CONDITIONS

Five strains of mung varieties/ strains alongwith two checks were evaluated for whitefly population development. Maximum average white fly population 6.5 per leaf was found on BRM-352 and CH. M-06.

SCREENING OF WHEAT STRAINS AGAINST APHIDS

Eight wheat strains/varieties were screened against aphids (Fig. 2) in normal and late sown conditions, having layout system RCBD. The lowest population of aphids, 13.38 per tiller was noted on strain Gold-16 while highest population, 20 aphid per tiller was observed on Fsd-08 in normal sowing condition. In late sown crop the maximum population of aphids, 34.16 per tiller was recorded on 109384 and minimum population 27.86 aphids/tiller on Aas-11.

LOSSES OF WHEAT YIELD CAUSED BY APHIDS

An experiment was conducted to evaluate the yield losses caused by wheat aphids (Fig.2)



Fig. 2, Wheat spike affected by aphids

Two sets of four varieties were sown separately. One set was kept free from aphid attack by applying Imidacloprid @ 250 ml/acre at the appearance of pests till maturity of the crop. 2nd set, was kept unsprayed to develop the aphid. Grain yield of the treated and non-treated plots were recorded for comparison. Yield loss caused by aphid was noted as ranged from 27.52% to 35.38% on varieties 076422 and Fareed-06 respectively.

SCREENING OF BRASSICA AGAINST APHIDS

Eleven new genotypes were tested against aphid in normal and late sown crop. The highest population of aphid i.e. 34 per 5cm inflorescence was recorded on strain BRJ-1103 and lowest aphid's population 14.0 per 5cm inflorescence was recorded on BRJ-1004 in normal sown condition. Under late sown condition the highest aphid's population 45 per 5cm inflorescence was recorded on strain BRJ-1103, while lowest aphid population 30 per 5cm inflorescence was recorded on BRJ-1104.



Fig. 3 Aphid attack on brassica

RESPONSE OF CHICKPEA STRAINS AGAINST POD BORER

Ten chickpea strains/varieties were screened against pod borer under non sprayed condition. The objective was to find out the response of different strains of chickpea against *Helicoverpa armigera* Hb, under natural field conditions. Percentage pod damage was as high as 63% on strain BRC-427.

LOSSES OF CHICKPEA YIELD CAUSED BY POD BORER

Fig.4, Borer attack on chickpea

An experiment was conducted to evaluate the yield losses caused by gram pod borer (Fig.4) under non sprayed condition.

Two sets of four varieties were sown separately. One set was kept free from *Helicoverpa armigera* attack by applying Emamectin1.9E.C @ 200 ml/acre at the appearance of pests till maturity of the crop.

2nd set of crop was kept unsprayed to develop the *Helicoverpa armigera*. The yields of the treated and non-treated plots were recorded for comparison.

Yield loss caused by pod borer was noted as 52% & 61% on strain BRC-428 and Bhakkar-11 respectively.



METEOROLOGICAL DATA

Factors	November 2015		November 2016	
	Average	Range	Average	Range
Temp. (Max. °C)	26	23-30	33	29-37
Temp. (Min. °C)	15	12-20	17	13-22
Humidity (%)	70	60-78	63	49-73
Rainfall (mm)	-		-	
Cloudy Days	-		-	
Factors	December 2015		December 2016	
	Average	Range	Average	Range
Temp. (Max. °C)	20	16-25	27	25-33
Temp. (Min. °C)	09	07-13	11	08-15
Humidity (%)	68	64-82	73	64-88
Rainfall (mm)	-		-	
Cloudy Days	-		03	
Factors	January 2016		January 2017	
	Average	Range	Average	Range
Temp. (Max. °C)	18	15-24	18	15-21
Temp. (Min. °C)	07	05-12	07	04-09
Humidity (%)	69	64-83	89	83-95
Rainfall (mm)	Light shower		08	
Cloudy Days	03		02	
Factors	February 2016		February 2017	
	Average	Range	Average	Range
Temp. (Max. °C)	25	21-30	28	23-32
Temp. (Min. °C)	10	09-14	11	08-15
Humidity (%)	68	60-79	73	59-86
Rainfall (mm)	03		05	
Cloudy Days	03		03	
Factors	March 2016		March 2017	
	Average	Range	Average	Range
Temp. (Max. °C)	28	20-37	34	26-42
Temp. (Min. °C)	14	12-18	18	12-24
Humidity (%)	76	68-84	74	56-90
Rainfall (mm)	32		Nil	
Cloudy Days	04		02	
Factors	April 2016		April 2017	
	Average	Range	Average	Range
Temp. (Max. °C)	35	31-43	37	34-43
Temp. (Min. °C)	21	17-22	25	18-33
Humidity (%)	65	61-82	71	63-82
Rainfall (mm)	04		Traces	
Cloudy Days	09		03	
Factors	May 2016		May 2017	

	Average	Range	Average	Range
Temp. (Max. °C)	42	36-47	45	42-48
Temp. (Min. °C)	27	22-31	27	22-32
Humidity (%)	60	51-70	76	60-91
Rainfall (mm)	02		15	
Cloudy Days	02		03	

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RADIO TALKS: Thirteen (13) on different aspects of production & protection technology.

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