Pulses Research Institute, Faisalabad

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Overview

Pulses are part of a healthy, balanced diet and have been shown to have an important role in preventing illnesses such as cancer, diabetes and heart disease. Pulses are very high in fibre, containing both soluble and insoluble fibres. Soluble fibre helps to decrease blood cholesterol levels and control blood sugar levels, and insoluble fibre helps with digestion and regularity. These provide important amounts of vitamins and mineral. Some of the key minerals in pulses include: iron, potassium, magnesium and zinc.

In addition to contributing to a healthy, balanced diet, pulses nutritional qualities make them particularly helpful in the fight against some non-communicable diseases. The World Health Organisation estimates that up to 80% of heart disease, stroke, and type 2 diabetes and over a third of cancers could be prevented by eliminating risk factors, such as unhealthy diets and promoting better eating habits, of which pulses are an essential component.

Pulses have also been shown to be helpful in the prevention of certain cancers, because of their fibre content but also because of their mineral and amino-acid contents, in particular folate. Pulses are included in all 'food baskets' and dietary guidelines. The World Food Programme (WFP) for instance includes 60 grams of pulses in its typical food basket, alongside cereals, oils and sugar and salt.

Several studies have shown that legumes are been associated with long-lived food cultures such as the Japanese (soy, tofu, natto, miso), the Swedes (brown beans, peas), and the Mediterranean people (lentils, chickpeas, white beans) and that they could be an important dietary factor in improving longevity.

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 (PRI), Faisalabad during 1982. Pulses Research Institute has three sub-stations; at Kallurkot (Bhakkar), Rakhuttra (Khushab) and Sahowali (Sialkot). Since its inception Institute has developed 21 varieties of pulses covering 90% area of Punjab and 80% of 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. In this regard, advance lines of chickpea Kabuli K-09012 and lentil V-10502 has been approved by the expert sub-committee and their cases of final approval are being submitted in the upcoming Punjab Seed Council meeting. Similarly the spot examination of Lentil advance line LPP-12161 was carried by the team of experts from different disciplines and its case is being submitted to expert sub-committee.

CHICKPEA (Desi) (*Cicer arietinum* L)

Chickpea is the third most important food legume grown globally.

Germplasm studies and advancement of breeding material:

It is actually works just like a bank so we call it gene bank to save our germplasm genotypes for future use. Six fifty five entries at Gram Breeding Research Sub-Station, KallurKot are being characterized and maintained in gene pool to use them as desirable parents in hybridization program. The crop is still in the field

We attempted thirty (30) new cross combinations would be and twenty seven (27) F_1 crosses are being evaluated for the advancement of F_1 and F_2 generations, respectively. In F_2 generation, Twenty one (21) cross combinations are being evaluated for the advancement of F_3 generation. More than one thousand (1000) single plant

progenies are being maintained from F_3 to F_5 generation. Four hundred and ninety (490) progenies would be selected for generation enhancement. Eighty (80) uniform lines from F_6 would be selected for assessing the yield potential in preliminary yield trials.

Fig.1 Overview of PRI Experimental Area

Station Yield Trials:

Role of experimental *station yield trial data* is that superior management practices and techniques are used and therefore the *results* may not reflect the on-farm situation.

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 would be evaluated at Pulses Research Institute (PRI) Faisalabad and Gram Breeding Research Sub-Station (GBRSS) Kallurkot.

Fig. 2 Matured chickpea plant in the field.

Chickpea Field Trials

Yield trials generate observations of *yield*, ordinarily replicated, for a number of genotypes grown in a number of environments (site-year combinations). Plant breeders use *yield trials* to identify promising genotypes, and agronomists use them to make recommendations for farmers.

In advance yield trial we study sixteen at two different locations i.e. Faisalabad and Kallurkot.

Fig.3 Blooming stage of Chickpea

Fig.4 Cooperative Yield Trial chickpea

Co-operative Yield Trials:

It is actually a coordinated venture. A co-operative yield trial are being sown at thirteen (13) different agro-ecological locations of Punjab with the collaboration of PRI, Faisalabad and other sister organizations. Twenty Eight lines (28) of PRI and sister Organization would be evaluated. The crop is still in the field

National Uniform Yield Trial:

Pulses have a special role in food security on account of their ability to reduce protein malnutrition. This institute contributed seven advance lines in the National Uniform Yield Trials (NUYT) 2018-19 to test their performance at different ecological zones but the results are still awaited from National Coordinator on Pulses Programme NARC Islamabad.

Seed production:

For Pre-basic and basic seed production, Chickpea Desi varieties Bittal-2016, Punjab 2008 and Bittal-98 are planted.

CHICKPEA Kabuli (*Cicer arietinum* L.)

Performance of New Chickpea Kabuli Advance Lines at National Level:

The *National Uniform* Yield Trials (NUYT) is a multi- environmental trial link between genetic improvements and the production environments. Four chickpea kabuli advance lines are being contributed in NUYT (2018-19) by PRI, Faisalabad to test their performance at different ecological zones.

Fig.5 Kabuli Advance Line

Germplasm Studies and Advancement of Breeding Material:

Conserving the genetic diversity of our crops, landraces and related wild species is essential to ensure future plant breeders can access this variation. Three hundred and twelve (312) germplasm entries are being characterized and maintained in order to find desirable parents for utilization in hybridization scheme. Twenty Four (24) F_0 cross combination would be attempted. In F_1, F_2 generations single plants will be selected from 23 and 21 cross combination. From F_3 to F_5 336 progeny rows will be selected respectively for generation advancement. In F_6 generations 90 uniform promising lines would be selected for preliminary yield trial.

Station Yield Trials:

The objective of these trials was to evaluate the promising lines for yield performance and disease tolerance. In Preliminary Yield Trials (PYT-I & PYT-II) are being conducted at Pulses Research Institute (PRI) Faisalabad and GBRSS, Kallurkot. Advance Yield Trials (AYT) are being evaluated at PRI, Faisalabad, GBRSS, Kallurkot and PRSS, Rakhuttra.

Adaptation Yield Trials:

These trials are planned to test the performance of advanced lines at different locations. Micro Yield Trials is going to be conducted at five locations i.e. Pulses Research Institute (PRI)

Faisalabad, GBRSS, Kallurkot, PRSS Rakhuttra, Karor and Feteh Jhang. The Cooperative Yield Trial is going to be conducted at 09 locations in which total 18 entries are evaluated.

Seed Production:

Noor-2009 and Noor-2013 chickpea Kabuli varieties are planted for Pre-basic and Basic Seed production.

LENTIL *(Lens culinaris .L)*

Lentils, cultivated ever since the advent of early agriculture, have been a part of our diet for quite long now. They provide multiple health benefits, including the following: Lentils contain the highest amount of protein originating from any plant. The amount of protein found in them is up to 35%, which is comparable to red meat, poultry, fish, and dairy products. As per the USDA, raw lentils contain carbohydrates (15-25 grams per 100 grams). They are a good source of dietary fiber and also have a low amount of calories. Other nutritious components found are molybdenum, folate, tryptophan, manganese, iron, phosphorus, copper, vitamin B1, and potassium.

Fig.6. Lentil matured single plant

Germplasm studies:

It acts like a gene factory for storage of superb research material in our institute. Lentil germplasm comprising of 246 local along with 8 exotic entries are being characterized and maintained for utilization in the breeding programme.

Fig. 7 Farmer day at district T.T.Singh

Preliminary Yield Trial:

In this experiment we have two sets. In Preliminary yield trial set –I and set-II of thirteen entries each, including two checks are being evaluated.

Advanced Yield Trial:

Twelve Entries are being tested in the advance yield trial at three different locations i.e. Faisalabad, Sahowali (Sialkot) and Kallurkot.

Micro Yield Trial:

In Micro yield trial twelve entries including two checks are evaluated for yield performance at seven different locations.

Fig.8 Lentil advance line LPP-12161 DUS Studies Plot

Evaluation of Advanced Lines of Lentil against Drought:

Fourteen entries including two checks are planted for drought tolerance studies.

Seed Production:

BNS, Pre-basic and Basic seed of Punjab Masoor 2009 are being produced in order to supply seed of approved variety.

MUNGBEAN (*Vigna radiata* L. Wilczek)

Fig.9 mung bean pods

Evaluation of Germplasm:

In gene bank of mung crop we have three hundred and Ten (310) entries were maintained and evaluated during Kharif season. On the basis of superiority for different traits, nine genotypes were selected for hybridization program.

Fig.10 Mechanical harvesting of mung bean

Study of filial generation:

It is a developing component for variety evolution then comes the evaluation part. Twenty new cross combinations were attempted and successfully harvested all the attempted cross combinations. Three hundred and Sixty six single plant progenies were selected from F_1 to F_6 generations for future studies.

Preliminary & Advance yield trials:

Selected progenies from F6, we make preliminary yield trial. In preliminary yield trial 10 entries including two checks were tested. Six advance lines (17004, 17003, 17006, 17008, 17007 and 17005) surpassed the better checks; NM-16 and AZRI-2006 with respect to yield. In Advance yield trial, 09 entries including two checks were tested. Six entries16005, 16002, 16006, 16004, 16003 and 16001 surpassed the better checks.

Micro yield trial:

In micro yield trial 09 entries including two checks were tested, out of which 6 entries viz: 15002, 15005, 15001, 15007, 15004 and 15003 gave the higher yield than the checks; AZRI-06 and NM-16.

NUYT Result:

Mungbean NUYT results are awaited from National Coordinator pulses NARC Islamabad.

Seed production:

In this part of research work, Two Thousand Two Hundred (2200 kgs) pre-basic seed of AZRI M-2006 and 125 kilogram PRI MUNG 2018, as well as 2710 kilogram basic seed of AZRI M-2006 was produced.

Fig.11 matured mung bean crop in field.

Mung bean advance line 08009 approved as PRI-MUNG 2018 having bold seeded, short duration, erect type plant structure bearing pods on the top of the plant suitable as a catch crop in between the existing cropping system as well as for mechanical harvesting.

MASH (*Vigna mungo* L. Wilczek)

Mash is an important leguminous crop grown in both spring and kharif season. It takes less time to mature and also insect pest attack is

low in spring season as compared to kharif (autumn) season. It is highly contained with good quality proteins and other important vitamins. Punjab produces 80% of its total production in Pakistan. It is mostly grown in barani areas i.e. 88% mash is cultivated in Narowal, Rawalpindi. Chakwal, Jehlum, D.G. Khan and Gujrat.

Germplasm studies:
To improve the gene pool, it is necessary to add superb genotypes of mash to mash gene bank. Mash Germplasm of this institute comprising of 303 (70 local + 160 USA + 73 PGRI =303) lines was maintained, characterized and utilized in hybridization. Plant height (22 cm -74 cm), No. of pods/plant (12-60), no. of seeds/pod (4-6), 1000 grain weight (25-45 g), yield/plant (2.80-14.00 g), days to flowering (40-50), days to maturity (90-120) and harvest index (6.92-30.60%) were recorded.

Hybridization and study of filial generations:
This study was designed to create variability by making crosses among the elite lines/ cultivars. Fifteen cross combinations were attempted and 13successful crosses were harvested for further studies. Whereas 120 single plant progenies from F_2 to F_6 were selected for further studies.

Preliminary yield trial:
This is initial step for variety evaluation process. In Preliminary yield trial Sixteen entries including check were evaluated at Faisalabad, Entry 18M008 gave significantly higher yield (1958 kg/ha) than check Arooj -11 (1829 kg/ha).

Advanced yield trial:
This experiment conducted at two locations to note the performance of advanced lines. In Advanced yield trial twelve entries including check were evaluated. Mash Entry No. 17M011 produced highest yield 2835 kg/ha than the check Arooj -11 which has 2585 kg/ha.

Micro yield trial:
In Micro yield trial 12 entries including check were evaluated. Mash Entry 16M006 secured top position by yielding 2623 kg/ha than check Arooj -11 which yielded 2612 kg/ha.

Seed production:
357 kg pre-basic and 1934 kg basic seed of Mash Arooj was produced.

COWPEAS (*Vigna sinensis*)

Testing of advanced lines in yield trials:
In preliminary yield trial, CP-72 produced the highest yield (737 Kg/ha), followed by CP-017 (701Kg/ha). In advance yield trial 2 entries out yielded the check variety i.e. (793and 755 Kg/ha.) S.A. dandy. In micro yield trial 2 entries out yielded the check variety S.A. dandy. Maximum yield was given by Cp-065 (657 kg/ha) followed by CP-017 592 Kg/ha.

DRY PEAS (*Pisum sativum* L.)


Fig. 12 Dry peas crop in field

Field peas also called dried peas are grown specifically to be used dried. Dried peas are used in soups, pastas, cereals, and purées. Dried field peas are available at farm markets whole or split.

Maintenance and evaluation of germplasm:
In this evaluation section we have one hundred and three genotypes of dry peas (*Pisum Sativum L.)* these are being maintained and evaluated for different characteristics. In hybridization programme, 30 new cross combinations would be attempted and One Hundred Five cross combinations from F_1 to F_6 would be studied.

Fig. 13 Seed of dry peas 2018 variety

Preliminary Yield Trial:

This is the first step in evaluation phase of variety approval. Sixteen advanced lines are being evaluated for yield in two sets of preliminary yield trial.

Advanced Yield Trial:

This experiment was sown on two locations. In Advance Yield Trial, sixteen advance lines including two checks is being evaluated for yield.

Micro Yield Trial:

In Micro Yield Trial, twelve lines including checks are also being evaluated for yield.

Dry peas advance line DP-09-08 got approved as dry peas 2018 possessing high yield, bold seeded and resistant to powdery mildew and rust. It is suitable for irrigated as well as in barani areas of Punjab.

Fig.14 Dry peas beautiful pods attached to plant

PLANT PATHOLOGY

Main emphasis is on the screening of breeding material against different diseases of pulse 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)

In this disease testing experiment we have Hundred (100) lines/varieties including check of Mung bean which were evaluated against MYMV and ULCV. Each entry was planted in 3 meter long and 30cm apart single row during the 1st week of July. Mung Kabuli, highly susceptible to MYMV was sown as spreader after every two test entries. Twelve lines i.e. Line No. 167, Line No. 303, RC-63, Line No. 77, Line No. 166, 230-27-680-4 11-2,E-182-1, NM-92, Line No. 10-10, Kark-2 and Line No. 161 were found Moderately resistant, while 48 lines were found moderately susceptible, 33 susceptible and 7 highly susceptible against MYMV.

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

This is pathogen related section. During the 1st week of July, each entry was sown 3 meter long and 30 cm apart single row replicated thrice. A highly susceptible variety kandhari Mash was sown as spreader after every two test entries. 30 advance lines including check were evaluated against MYMV and (ULCV), out of these entries, 12 lines were found Resistant while remaining lines were found to be susceptible against Mungbean Yellow Moasic Virus. Similarly these lines were also tested against ULCV. The results indicate that 20 lines were found resistant against ULCV while all other entries are susceptible.

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

In this disease test experiment, each entry was planted in 3 meter long and 30 cm apart single row during the 1st week of July. A highly susceptible variety Desi Arvan was sown after every two test entries as spreader. Ten advance

lines were evaluated against CYMV. All these lines were found resistant against CYMV.

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

This experiment was sown in research area of pulses research institute Faisalabad. 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 14003 was sown after every two test entries. Twenty test lines were evaluated against cercospora leaf spot. Out of 20 lines/varieties, 1 line was found resistant whereas 17 lines were found Moderately resistant, 1 were susceptible and 1 were highly susceptible in natural conditions.

Management of cercospora leaf spot in mungbean by using different Fungicides

It is also sown at research area of pulses Faisalabad. In this experiment Cercospora leaf spot susceptible variety 14003 was planted in RCBD having three replications. After 40-45 days of sowing the disease inoculum was sprayed. As the disease appears in epidemic form, different fungicides are used to control its severity. Score 250 EC gave the maximum control 77.41 % decrease disease over control.

Chickpea lines/ varieties against Blight

This is a gram related pathological trial. 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 chickpea lines/ varieties (Desi & Kabuli) was screened out against blight in a sick bed. The data is being compiled.

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 chickpea lines/ varieties (Desi and Kabuli) were screened out against root rot complex in a sick bed. The data is being compiled.

Screening of lentil germplasm against wilt and root rot diseases

The trial was sown at pulses research area Faisalabad in 3m × 0.30 m plot with 3 replications. M-85 was sown as check entry which was repeated after every 2 lines. Sixty lentil germplasm lines were evaluated against root rot diseases. The data is being compiled.

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 entries. 100 lines/genotypes are tested against the Rust. The data is being compiled.

BACTERIOLOGY

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

The trial is conducted to identify the best suited Rhizobium - PGPR co inoculation for optimum Chickpea production. Treatments viz. control (25-60-0) T_1, Rhizobium specie of chickpea (T_2), Azotobacter ($PGPR_1$) T_3 and bacillus ($PGPR_2$) T_4, Rhizobium + $PGPR_1$ (T_5) and Rhizobium + $PGPR_2$ (T_6) are being applied. The Crop is still in the field.

Biofortfication of Rabi Pulses by Zinc Application

It is also planted in Faisalabad. The trial is conducted to see the effect of zinc application on Rabi pulses (Chickpea Desi, Chickpea Kabuli and Lentil). Treatments viz T_1 control (25-60-0 NPK kg/ha), T_2, 2.5 kg Zn/ ha, T_3, 5.0 kg Zn/ ha, T_4 2.5 kg Fe/ha, T_5 5Kg Fe/ha, T_6 2.5 Kg zn + 2.5 Fe/ha, T_7 5Kg Zn + 5Kg Fe/ha, T_8 0.1 % $ZnSO_4$ (2 Sprays: one at flowering and 2nd 15 days after first spray) are being maintained.

Nutritional Quality of Chickpea Genotypes Due to Microbial Inoculation

Pulses have a special role in food security on account of their ability to reduce protein malnutrition. It contains about twice as much as protein as cereals. Keeping in view the present

study the experiment is designed to improve the nutritional value of chickpea through microbial inoculation. Recommended dose (25-60 N, P kg/ha) of fertilizer is applied to both inoculated and un-inoculated plots. The advance lines of chickpea, one for Kabuli (K-70005) and one for Desi (D-10008) are being tested for yield. The crop is still in the field.

Response of Mungbean to Rhizobium and PGPR Co-inoculation

The trial was conducted to identify the best suited Rhizobium - PGPR co inoculation for optimum Mungbean production. Treatments viz control (25-60-0) T_1, Rhizobium species for Mungbean (T_2), Azotobacter ($PGPR_1$) T_3 bacillus ($PGPR_2$) T_4, Rhizobium + $PGPR_1$ (T_5) and Rhizobium + $PGPR_2$ (T_6) were tested. Results showed the maximum grain yield (2192 Kg/ha) was achieved by the application of T_2 and minimum grain yield (1497 Kg/ha) was achieved in T_1 (control) where the seed was not inoculated.

Nutritional Quality Evaluation of Mungbean and Mashbean Genotypes due to Microbial Inoculation

Following is the aim of experiment to improve the nutritional value of mung bean and mash bean through microbial inoculation. Recommended dose (25-60 N, P kg/ha) of fertilizer was applied to both inoculated and un-inoculated plots. Six mung bean genotypes namely Azri-2006, NM-2016, 15003, 14005, 15005 and PRI-Mung-2018 were evaluated. Similarly six mash bean genotypes (Arooj-2011, Mash-97, 15-M001, 15-M002, 15-M004 and 15-M008) were tested. The results showed that inoculated PRI-Mung-2018 gave maximum grain yield (1832 kg/ha) as compared to un-inoculated (1696 kg/ha). In case of mash bean inoculated Arooj-2011 gave the maximum grain yield (1074 kg/ha) as compared to un-inoculated (992 kg/ha). The results indicate that inoculation of seed increase the grain yield in all six genotypes of both crops.

BIO-FORTIFICATION OF KHARIF PULSES BY ZINC AND IRON APPLICATION

This experiment is the need of our Punjab soils. Zinc (Zn) and Iron (Fe) deficiency have been reported in our soil which leads to malnutrition. Therefore this study was planned to increase the yield through Zn and Fe application in Mung & Mash crop. Recommended dose (25-60 N, P kg/ha) of fertilizer was applied to all treatments. Six Mung bean and Mash bean genotypes viz. (Azri-2006, 14005, 14009, 15001, 15004, 15005) and (Arooj-2011, 16-M003, 16-M004, 16-M005, 16-M006 and 16-M009) were tested. The treatments were applied T_1 (Control) T_2 (2.5kg/ha Zn) T_3 (5kg/ha Zn), T_4 (2.5kg/ha Fe) T_5 (5kg/ha Fe) T_6 (2.5 kg/ha Zn and 2.5kg/ha Fe) T_7 (5kg/ha Zn + 5kg/ha Fe) T_8 (0.1% $ZnSO_4$, two Spray: 1st at flowering and 2nd 15days after 1st spray) T_9 (0.1% $FeSO_4$, two spray: 1st at flowering and 15 days after 1st spray) and T_{10} (0.1% $ZnSO_4$ + 0.1% $FeSO_4$ two Spary: 1st at flowering and 2nd 15 days after 1st spray). The results revealed that in Mung bean crop maximum yield was achieved in T_7 and minimum in T_1 control in all six genotypes. Similar results were also found in Mash genotypes. The results obtained so far showed that application of micronutrients (Zn and Fe) increase the crop yield.

ONGOING PROJECTS

1. **PARB PROJECT-532**
   Development of Short Duration, high yielding and disease resistant mungbean cultivars in Rice-Wheat cropping system.

2. **PARB PROJECT-909**
   Weed Management in Chickpea through Identification of Post Emergence Herbicide and Development of Herbicide Tolerant Genotypes.

3. **PARB PROJECT-910**
   Development of Weedicide Tolerant Lentil Germplasm and Identification of different Weedicide for weed control in Lentil.
4. **CIMMYT-AIP PROJECT**
   Identification of climate Resilient Chickpea Genotypes for Mitigating Climatic Impacts on Yield Potential.
5. **CIMMYT-AIP PROJECT**

Strengthening of Mash Germplasm and Identification of High Yielding and disease Genotypes.

PUBLICATIONS

Asghar M.J, K. Akhtar, G. Abbas, M. Rizwan, M. Iqbal, M. Idrees, S. Ali, M. Aslam, M. Rafiqe, A. Rehman, U. Saleem and M. E. Khan (2018) Identification of multiple sources of resistance in lentil against some potential fungal diseases. Pak.J. Agri. Vol.55(4):875-880; 2018.

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Nourin A., A. Kiran, S. Kaukab, A. U. Rehman, M. S. Saeed, A. Tahir, G. Riasat and E. Khan (2019) Evaluation of lentil genepool for yield and some yield related attributes. *Universal Journal of Agricultural Researc*. 7(1): 32-62.

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Training received from Ist. July 2018 to date

Sr. No	Name of Training	Participant Name	Duration		Host Institute
			From	To	
1	Monitoring and Evaluation	M. Irfan Rasool	30-09-2018	30-09-2018	Ayub Agricultural Research Institute, Faisalabad.
2	Emerging Technologies in Research; "Advanced MS. Office & Digital Resources"	Ms. Sadia Kaukab Muhammad Amin	24-09-2018	25-09-2018	Ayub Agricultural Research Institute, Faisalabad.
3	Hands on Training for Statistical Data Analysis	Dr. Anwar-ul-Haq Ms. Sadia Kaukab Muhammad Amin	19-09-2018	19.092018	Ayub Agricultural Research Institute, Faisalabad.

Urdu Articles

Sr. No	Name Of Article	Author's Name	Published	Publishing Agency
1	Moong ki Baharia Kashat	Muhammad Sajjad Saeed & Ch. M. Rafiq	Zarat Nama 1-15 March 2019	Directorate of Agricultural Information, Govt. of the Punjab, Lahore