International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm

March 25-27, 2019

Organized by

Institute of Plant Breeding and Biotechnology

MNS-University of Agriculture Multan

Contents

Executive Summary

Fodder and forages are considered as backbone of dairy industry, and without it, survival of livestock is impossible. It is proposed that fodder crops are rich source of vitamins and minerals for livestock and almost 80-90% nutrition is met by these fodders. Therefore, there is tremendous pressure of livestock on available total feed and fodder. Currently, livestock growth is insufficient to fulfil the requirements of meat and milk products for rapidly growing population in Pakistan. Unavailability of nutritional quality feed to livestock is the major constraint for its reduced production. The major factors viz. climate change, poor cultivation and feed techniques, contributing towards poor animal health and growth. The malnutrition has increased the susceptibility of livestock systems to certain diseases that can cause severe loss of sustainability in farming system and economic stability. It is also predicted that acute fodder deficiency during the month of May-June and November-December rigorously affects the milk and meat production in Pakistan. Furthermore, poor quality fodder production owing to scare crude protein and digestibility, is the main cause of reduced growth of dairy animals for milk and meat production. The current situation, however, indicate that livestock feed is deficient in total digestible nutrients and proteins. The conference was a big step towards sustainable fodder production in Pakistan by exploring potential strategies and innovations to boost production and profitability of fodder crops in changing climate. The unified model on a mission mode will be the roadmap for food security. Keeping in view the importance of fodder and forage production in the current scenario of climate change the institute of Plant Breeding and Biotechnology MNS-University of Agriculture Multan in collaboration with The UC Davis, USA, Fodder Research Station (FRS), AARI Faisalabad and University of Agriculture Faisalabad has organized an international conference. A meeting was conducted at AARI with the foreign delegates and recommendations were made after one day field visit at AARI on 25th March, 2019. The foreign delegate, Researchers, government officials, industry representatives, agri-entrepreneurs and other agricultural research stakeholders came together on March 26-27, 2019, at MNS-University of Agriculture Multan. The conference fostered important discussions about fodder Production and its management in a changing climate. Over two days, conference participants and speakers shared their views and expertise around the following themes:

- Breeding and biotechnology of climate resilient fodder
- Climate smart crop husbandry and management
- Value addition and economics

- Fodder and feed formulation for livestock
- Crop modelling for fodder production.

This event provided a great opportunity to share experiences, talk about modern trends in the development of modern day fodder crops and simply discuss what needs to be done to make the crop more productive, to find better methods, and to improve the management practices. The recommendations derived from the technical sessions were presented by Prof. Dr. Daniel Putnam at the concluding session. Furthermore, the foreign delegate along with national progressive growers, private sector representative also visited the alfalfa field at MNS-UAM and Khanewal. The foreign scientists appraised the alfalfa production technology and were agreed that in future this technology will be fruitful in alleviating the food security problems.

RECOMMENDATIONS

The recommendations derived from the technical sessions were as follows.

- It is a critical need to improve fodder crops for the future of Pakistan agriculture –this is a much neglected area.
- Public-private partnership needs to be promoted in research and development, seed production, and seed business.
- Fodders are needed to be climate resilient fodder for the different climatic zones of the Pakistan (species, varieties).
- Determination of quality of improved fodder with better palatability and digestibility may be focused in our breeding programs.
- Develop high quality both domestic and imported certified seed sources that improve yields and quality and pest resistance. Take advantage of international experience.
- Silage!!! Haymaking!! Develop improved methods of silage making (inoculants, methods) and haying. Preserve high quality!!!
- Water Water Water Water!!! – Irrigation specialists are needed!! Adaptation of varieties to salinity conditions and water stress.
- Herbicide, insecticides, resistance, mechanization of the harvest, variety adaptation programs, fertilizer management should be adapted for the better quality fodder and forage production.
- Pakistan requires diverse fodder crop options, (berseem, sorghum, maize, alfalfa, grasses, alternatives).

- Strengthening of fodder research institutes/stations and capacity building of fodder scientists (students, faculty)
- Both sorghum and maize have strengths as fodder crops, but must be managed differently. High quality sorghum varieties are needed (BMR and Braccitic).
- Lots of work needed on agronomic practices: soil fertility, weed management, cutting schedules, insects, forage quality measurement.
- Look for science which impacts and benefits farmers.
- Scientists should learn from the international experiences but formulate unique Pakistani solutions.

LIST OF INTERNATIONAL KEYNOTE SPEAKERS

Sr. No.	Name	Country	Affiliation
1	Prof. Dr. Daniel Putnam	USA	**Agronomist & Cooperative Extension Specialist** Experiment Station Research Scientist at UC Davis
2	Dr. Jeffery A. Dahlberg	USA	**Center Director** UC-ANR Kearney Agricultural Research & Extension Center
3	Dr. Khaled Bali	USA	***Statewide Irrigation Water Management Specialist*** *University of California-Division of Agriculture and Natural Resources*
4	Prof. Dr. Richard Trethowan	Australia	**Director** IA Watson Research Centre, The University of Sydney Australia
5	Prof. Dr. Harbans Singh Bariana	Australia	**Professor** School of Life and Environmental Sciences The University of Sydney Australia
6	Dr. Thistlethwaite Rebecca Janettee	Australia	**Postdoctoral Research Associate** The University of Sydney Australia
7	Dr. Nicholas Bird	UK	**Research Scientist** KWS, UK
8	Dr. Harpinder Singh Randhawa	Canada	**Research Scientist** Agriculture and Agri-Food Canada

LIST OF NATIONAL KEYNOTE SPEAKERS

Sr. No.	Name	Affiliation
1	Dr. Abid Mahmood	***Director General Agri. (Research)*** AARI, Faisalabad
2	Mr. M. Saleem Akhtar	***Director*** Fodder Research Institute Sargodha
3	Prof. Dr. Hafeez Ahmad Sadaqat	***Chairman*** Department Plant Breeding & Genetics, UAF
4	Dr. Muhammad Shafiq Zahid	***PSO/Program Leader (MSM&F), PI (IHSPT)*** NARC. Islamabad
5	Dr. Shaukat Ali Bhatti	***Associate Professor*** Institute of Animal and Dairy Sciences, UAF
6	Mr. Fida Gaddi	***CEO*** Bio track Pvt. Pakistan

LIST OF DIGNITARIES

Sr. No.	Name
1	**Dr. Akhtar Malik** (Provincial Minister for Energy)
2	**Mr. Syed Fakhar Imam** (Chairman Kashmir Committee)
3	**Dr. Ata ur Rehman**, (Graham Centre for Agricultural Innovation, Charles Sturt University Australia)
4	**Mr. Qasim Langah** (Member Provincial Assembly)
5	**Mr. Mumtaz Khan Manais** (Progressive Farmer)
6	**Col. (Rtd.)M. Ali** (Progressive Farmer)
7	**Syed Ibn-e- Hussain** (Retired D.I.G. Railway Police)
8	**Mr. Rasheed Ahmad Sandhu** (Maxim International Pvt.)

CONFERENCE PROGRAM

Monday, March 25th 2019

Meeting and Field Visit at AARI

Tuesday March 26th, 2019 (MNSUAM)

Opening Session

Time	Topic
09:30 am	Recitation
09:40 am	Welcome address by VC MNSUAM
09:50 am	Agronomic practices for high yielding and high quality Alfalfa forage (Dr. Daniel H. Putnam)
10:00 am	Potential of Fodder Improvement in Pakistan (Mr. Saleem Akhtar)
10:10 am	Address of Fida Gaddi (CEO, Bio Track)
10:20 am	Vote of Thanks
11:00 am	**TEA BREAK**

Rapporteurs: (i). Dr. Abu Bakar (ii). Dr. Ummara Waheed

Session 1: Animal Nutrition and Fodder Conservation Modern Tools for Crop Improvement

Venue: Seminar Hall
Chair: Dr. Dan Putnam
Co-Chair: Dr. Shaukat Ali Bhatti
Rapporteurs: (i). Dr. Abu Bakar (ii). Ms. Saima Rasheed
Moderator: Dr. M. Mahmood Ahmad

Time	Topic	Name of Scientist
11:30 am	Sorghum use as an animal feed: common mistakes and issues.	Dr. Jeffery A. Dahlberg
11:50 am	Increasing nutrient supply for livestock from the existing land resources	Dr. Shaukat Ali Bhatti
12:30 pm	Nutritive qualities of maize (*Zea mays*) silage in relation to dairy and poultry farming	**Dr. Muqarrab Ali**, Sarmad Frogh Arshad and Iqra Ghafoor
12:50 pm	QTL mapping for biomass traits of sorghum through association mapping.	**Dr. Sarmad Frogh Arshad**, Bushra Sadia, Faisal Saeed Awan, Hasan Junaid Arshad and Asma Shah Rukh
1:10 pm	Seed priming with molybdenum regulates physiological processes to improve maize fodder yield under drought stress.	**Dr. Muhammad Asif Shehzad**, Abdul Ghaffar, Fahim Nawaz, Muhammad Salman
01:30 pm	**Lunch Break**	

Session 2: Crop Management for Sustainable Production Fodder Breeding for Improving Yield and Quality

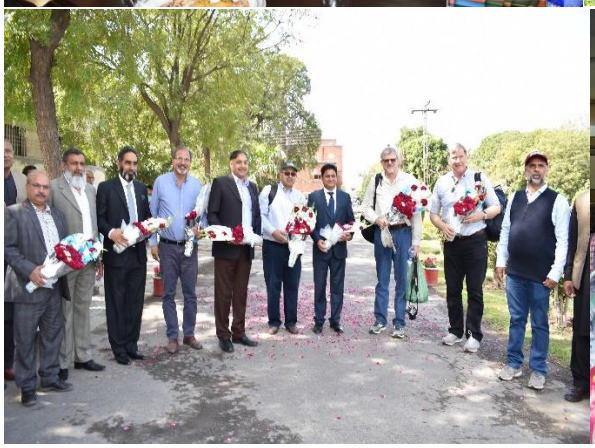
Venue: Seminar Hall
Chair: Dr. Jeffery A. Dahlberg
Co-Chair: Dr. Khaled M. Bali
Rapporteurs: (i). Dr. Abu Bakar (ii). Ms. Saima Rasheed
Moderator: Dr. M. Mahmood Ahmad

02:30 pm	On-farm water conservation water management for efficient irrigation of fodder crops.	Dr. Khaled M. Bali
02:50 pm	Effect of different sowing methods and cutting intervals on forage production of Alfalfa.	**Dr. Asif Iqbal**, Rizwan Maqbool, Shahid Iqbal Khan, Muhammad Tahir, Muhammad Ather Nadeem, Rao Muhammad Ikram
03:10 pm	Prospective of high efficiency irrigation system for fodder production in Pakistan under climate change scenario.	**Sarfraz Hashim** and Ahsan Raza
03:30 pm	Weed-crop interference effects quality of maize fodder.	**Nabeel Ahmad Ikram**, Asif Tanveer, Abdul Ghaffar, Mubbashir Gul, Ameer Ahmad
03: 50 pm	Genetic variability for agronomic traits in S1 maize families grown under normal and defoliation environments	**Dr. Ali Bakhsh**, Sohail Kamran, Irum Aziz, Nisar, Sanober Gul
04:10 pm	Development of selection criteria for water stress resilient fodder oat accessions on the basis of physiological indices at seedling stage.	**Dr. Sammina Mahmood**, M. Hammad Nadeem Tahir, Fizza Ghauri, Humera Razzaq
04: 30 pm	Improvement of *Medicago sativa* L. genotypes for fodder yield and quality related characters through mass selection.	Waqas Javed and Humera Razzaq
4:50 pm	Genetic evaluation of Sorghum bicolor germplasm for green fodder yield potential.	**M. Nouman Aslam**, M. Hammad Nadeem Tahir, Rabail Afzal and Humera Razzaq
5:10 pm	Genetic variability in the effect of seed weight on seedling, relative growth rate and fodder yield related traits in sorghum accessions.	**Hina Saleem**, Hafeez Ahmad Sadaqat, M. Hammad Nadeem Tahir and Humera Razzaq
5:30 pm	Morphological assessment of genetic variation for fodder yield and quality contributing traits in *Sorghum bicolor*.	**Amna Javaid**, Ameer Bibi, Hafeez Ahmad Sadaqat, Muhammad Ahsan and Humera Razzaq.
5:50 pm	Variability and interrelationship of various traits in fodder sorghum (*Sorghum bicolor* L.).	**M. Hayder Bin Khalid**, M. Hammad Nadeem Tahir, Humera Razzaq, and Fazila Ramzan

Wednesday March 27th, 2019

Visit of international delegate to the Alfalfa Farms (Rana Farms), 12AH Makhdoompura Road Khanewal

VISIT TO AARI (25-03-2019)



Meeting at AARI on 25th March 2019

Sr. No.	Name	Country	Affiliation
1	Prof. Dr. Daniel Putnam	USA	**Agronomist & Cooperative Extension Specialist** Experiment Station Research Scientist at UC Davis
2	Dr. Jeffery A. Dahlberg	USA	**Center Director** UC-ANR Kearney Agricultural Research & Extension Center
3	Dr. Khaled Bali	USA	***Statewide Irrigation Water Management Specialist*** *University of California-Division of Agriculture and Natural Resources*
4	Dr. Abid Mahmood	Pakistan	***Director General Agri. (Research)*** AARI, Faisalabad
5	Mr. M. Saleem Akhtar	Pakistan	***Director*** Fodder Research Institute Sargodha
6	Prof. Dr. Hafeez Ahmad Sadaqat	Pakistan	***Chairman*** Department Plant Breeding & Genetics, UAF
7	Dr. Noor ul Islam	Pakistan	***Ex-Chief Executive*** PARB
8	Dr. Masooma Cheema	Pakistan	***Assistant Professor*** Department Plant Breeding & Genetics, UAF
9	Dr. Qamar Shakeel	Pakistan	***Assistant Botanist*** Fodder Research Station AARI FSD
10	Mr. Rafiq Ahmad	Pakistan	***Botanist*** Pulse Research Institute ARRI FSD

Meeting was held at AARI and members from different industries, academia and research institutes showed their interest in it. The list of eminent scientist and researchers are as above and following were the recommendations of the meeting:-

- Alfalfa hay quality depend upon crop stage at cutting. If the management is for high yield and high quality, then the first cutting should be at the bud stage (May 20-25), the second cutting 28 to 33 days after first, and the third (and 4th) cutting 38 to 55 days after second or at the 10 to 20% bloom stage. Since forage quality changes rapidly early in the season, the cutting interval for all fields should be short.
- Sorghum can be used for silage production. Sorghum for forage is generally grown when production of corn silage is difficult due to limited water.
- Mixing of different fodder is necessity of time for sustainable dairy production. An optimized fodder mixing system is of great importance for each facility. By using our housing computers, different fodder mixing systems can be employed and adapted to fulfill your requirements.
- Alfalfa & berseem crop can be rotated with maize & SSHybrid. There are many benefits that can come from the use of crop rotations, regardless of the species used. Producers can diversify their operation to minimize financial risk, interrupt the life cycle of various diseases and insects, and add flexibility to their weed management program.
- Organic farming should be promoted. An organic cropping system consumed three to four times less energy than a conventional system. More recent research also shows that organic farming systems can be equally productive and economically competitive with conventional systems, and in some cases, more resilient.
- Alfalfa is mainly requires phosphorus fertilizers.
- Alfalfa, Sudan grass & vegetables intercropping is practiced in Central America. The advantages include reduces levels of diseases and pests, creation of a suitable micro-climatical soil improvement
- Cutting & Harvesting time is very important for dual purpose sorghum. An Alfalfa Development Board should be formulated to boost alfalfa production. There should be an Alfalfa Growers Association for coordination among alfalfa growers
- Development of both local & Oversea Markets for hay & silage in Pakistan. And Agricultural mechanization should be promoted even at small scale for the better

Production. Wheat can be processed into silage by harvesting it in Feb-March. Alfalfa accessions should be screened for fall dormancy. By fertigation in fodder crops the fertilizer input cost can be minimized. Corporate sector is producing 2 tons per acre haylage in 20-22 days. For efficient seed production in alfalfa there should be proper plant density, irrigation, pest management. Bee Pollinators also play role in good seed setting.

- Performance of local alfalfa seed is much better than imported ones. Alfalfa & Rhodes grass should be taken as cash crop.

ARRIVAL OF GUESTS AT MNSUAM (26-03-2019)

INAUGURAL CEREMONY

The inaugural session of the conference was started with the verses of the Holy Quran. Dr. Akhtar Malik (Provincial Minister for Energy), Mr. Syed Fakhar Imam (Chairman Kashmir Committee), Mr. Qasim Langah (Member Provincial Assembly), Syed Ibn-e- Hussain (Retired D.I.G. Railway Police), foreign delegate (Canada, USA, Australia, UK), Vice Chancellor MNS-UAM, Researchers, government officials, industry representatives, agri-entrepreneurs and other agricultural research stakeholders and progressive farmers participated in the conference.

Prof. Dr. Asif Ali, Vice Chancellor MNS-UAM welcome all the participants of conference, foreign delegate and other national keynote speakers and private sector representatives. After that Dr. Asif Ali gave brief introduction of the conference week. He said that MNS-University of Agriculture Multan is organizing this conference week in which three international conferences will be conducted. He appreciated the Prof. Dr. Daniel H. Putnam, Dr. Jeffery A. Dahlberg and Dr. Khaled M. Bali with overwhelming tribute on their great efforts in the scientific development. He also appreciated and congratulated to the organizers of the International conferences.

Prof. Dr. Daniel H. Putnam, PhD Cooperative Extension Specialist, Agronomist from the University of California, Davis presented the agronomic practices necessary for high quality alfalfa production. He mentioned the established practices, weed management, insect management, harvest schedules, variety selection, and harvesting methods in the US. He also reviewed the necessity and rewards for high quality production of alfalfa for dairy production with special emphasis on the need for high milk production resulting from quality forages. He mentioned that each of these factors are important, but when combined, they represent a 'package of practices' that together will result in high yields and high quality alfalfa production. He congratulated the Vice Chancellor Prof. Dr. Asif Ali and the organizers of the Conference and also appreciated the International delegates.

Fida Gadi from the Bio Track enterprise talked about the company, its history and its strong role in the management of customer/collaborator relations, investor interactions and into market trends, analysis and technological advances for the production of Alfa Alfa Rhode Grass and many other fodder crops. He explained that in a very short time the company has progressed and have achieved more than 100% growth in 2 Years working with 100 Staff work and more than 50 Brands. While he also recommended Some of the bransds including Bionic, Cup, Plasma, Fruitsy, Filp BS and Jadoo for the better growth and production of Fodder crops.

Muhammad Saleem Akhtar director Fodder Research Institute Sargodha talked about the "Challenges for Fodder Production in Pakistan under Climate Change". In his presentation he gave a good sketch about the present status of fodders in Pakistan, and explained that fodder Share of Agriculture to GDP is about 18.9%, share of livestock to Agri. GDP 58.9 %, while total fodder production area 55.47 Million tons while in Punjab the average yield of fodder 21.6 t/ha with 41.98 Million tons of fodder production in a total area of 1.86 Million ha with the major fodder crops including Berseem Alfalfa Sorghum Maize and Guar. He explained that selection of low yielding unapproved fodder varieties, less-availability of good quality and healthy seed , allocation of marginal land to the fodder crops, unawareness of improved fodder production technology biotic stresses (diseases, insect pests and weeds) and abiotic Stresses (drought, salinity, water logging and heat) are the major constrains in Fodder production in Pakistan. He also informed the audience about the recommended varieties of fodder crops including Oats (Avon PD2-LV65, SGD-81, S-2000, Sgd. Oats-2011 and NARC Oats) Berseem (Agaiti, Pachaiti, Anmol, Superlate F/Abad and Lyallpur late) Sorghum (JS-263, Hegari, JS-2002, Sorghum-2011 and Chakwal Sorghum) S.S. Hybrid (Pak-Sudax, NARC Shahtaj and NARC S.S. Hybrid) Pearl millet (M.B-87 and Sgd. Bajra-2011) Guar (BR-90, BR-99 and BR-2017).

Prof. Dr. M. Hammad Nadeem Tahir gave vote of thanks to the honorable guests and international scientists. He also appreciated the efforts of organizing team and university leadership for support to organize the conference. Dr. Hammad also thanked to the sponsors of the international conference and with these words he concluded the opening session of international conference.

Session 1. Animal Nutrition and Fodder Conservation Modern Tools for Crop Improvement

Venue: Seminar Hall MNS University of Agriculture, Multan

Chair: Prof. Dr. Dan Putnam Co-chair: Dr. Shaukat Ali Bhatti

Dr. Jeffery A. Dahlberg

Center Director UC-ANR Kearney Agricultural Research & Extension Center gave oral talk on "Sorghum use as an animal feed: common mistakes and issues". In his talk he explained that Sorghum (Sorghum bicolor (L.) Moench] is the fifth most important cereal crop in the world. Sorghum is extremely important as a cereal for human consumption in many areas of the developing world, but because of its versatility, more interest in its use as an animal feed is taking place. In the United States, sorghum is primarily used as animal feed and there is a long history of its utilization in different animal systems. The grain, when processed correctly is an excellent feed for poultry, pigs, dairy cattle and beef cattle. The forage can be used as greenchop, hay, and silage production and each requires different management strategies to optimize the quality and yield potential of the feed. Common issues and mistakes when using

sorghum can be: 1) improper hybrid or cultivar selection; 2) not processing grain or forage properly; 3) under or overplanting of the seed; 4) expectations that sorghum does not need water or fertilization; 5) all sorghum have tannins; and, 6) sorghum is a poor substitute for corn. If handled properly, sorghum is an excellent animal feed and can be extremely important in the development of a robust, profitable animal feed industry.

Dr. Shaukat Ali Bhatti

Associate Professor Institute of Animal and Dairy Sciences, UAF gave presentation on "Increasing nutrient supply for livestock from the existing land resources". In his talk, he explained that Fodder is the cheapest source for livestock feeding the world over. Livestock is mainly dependent on agriculture for their fodder supply. Land for fodder crop is decreasing day by day due to pressure for growing cash crops, in the country. On the other hand livestock population is increasing with every year passing by. Livestock in our country is short of nutrient supply and thus underfed. Therefore, t maximum production potential of livestock remains underutilized. It is required that more nutrients be harvested from the same (existing) land resources so that livestock productivity can be increasing by fulfilling their nutritional needs. Nutrient availability for livestock from the existing land resources can be increased using seeds of high yielding fodder varieties, better agronomic practices, harvesting the fodder at proper time (to harvest maximum nutrients than merely dry matter), preserving them in form of hay and silage, using chemical treatments for improving nutritional values of low quality crop residues, using ionophores (to reduce nutrient loss in the animal body) and using balanced diets (to avoid nutrient loss due to haphazard feeding).

Dr. Muqarrab Ali

Assistant Professor, Department of Agronomy MNS-UAM gave his oral talk on "Nutritive qualities of maize (Zea mays) silage in relation to dairy and poultry farming". He was of the view that Maize (Zea mays. L) is most important crop grown in the world. It contributes 2.2 percent to value added and 0.5% share in GDP of Pakistan. Maize ranks 3 position in world after wheat and rice crop. Maize can be used as animal feed in many ways by its processing. It provides high yield and best quality forage. Maize is used as silage crop because its digestible energy per hectare is more than other crops. Maize silage is the major crop component with respect to dairy cows in last few decades. Maize has potential of high yield (tons dry matter per hectare per cut) than all other grasses and leguminous crops used for silage purpose. The mineral composition of silage is depending on harvesting stage. The silage which is ensiled at very early stage has low starch content to nutrient detergent fiber ratio results in lower dry matter intake, milk yield and protein content. The dry matter intake and protein contents increases with

increasing maturity stage and attained optimum level for silage with dry matter percentage 300 to400 gram per kilogram. The dry matter content decreases after this level. Good fermented maize silage should be yellowish to brown in color, soft to touch, sour smell, leafy and high in protein content and metabolisable energy. The grain of maize is also used in poultry and cattle feed. Maize silage has crude protein 7.2% to 10 percent, acid detergent fiber 23 to 33% and neutral detergent fiber 41 to 54%. . Maize grass silage diets improved the forage dry matter intake by 2 kg per day and milk yield by 1.9 to 2 kg per yield and milk protein content by 1.2 g per kilogram. In terms of milk and milk constituent yields depends on the quality of maize silage. During fermentation due to partial hydrolysis nitrogen free extract provides additional sugar for lactic acid. Maize Silage has 23% crude fiber and ether extract 5.8% and 10%ash. In short for silage purpose maize has best characteristics than other crops. All parts of maize plant used as feed for animals and poultry. Maize silage is best for ruminants, dairy cattle's, beef cattle, sheep and goats. Farmers grow maize and get outstanding profits in this changing climate scenario.

Dr. Sarmad Frogh Arshad

Assistant Professor Institute of Plant Breeding and Biotechnology MNS-UAM, presented oral talk on topic "QTL mapping for biomass traits of sorghum through association mapping". He said that Sorghum (*Sorghum bicolor* (L.) Moench) is an important fodder crop with high biomass production potential across the world. Genetic divergence was estimated among 208 Pakistani sorghum genotypes by evaluating the fourteen different quantitative traits for same planting season of two years. Broader variability was revealed in fresh biomass, dry biomass, flag leaf area index, leaf area index and plant height. Broad-sense heritability was reported to be more than 80% for all traits in both seasons. The principal component analysis showed that first three PCs with Eigen value >1 shared 75.39% variability in the 1st year and 71.21% variations of 14 quantitative traits in the 2nd year. Pearson correlation analysis showed that fresh and dry biomass had significant positive correlation with leaf area index, number of leaves per plant, flag leaf area index, days to maturity and 50% days to flowering for two seasons. Unweighted Pair-Group Method analysis (UPGMA) Cluster analysis classified the germplasm into 141 morphotypes and seven classes in the first year and 136 morphotypes and 5 classes in the 2nd year. The genotype P-13-2013 was found to be the best performer in relevance to the traits such as number of leaves per plant, stem thickness, leaf length, fresh biomass, dry biomass and flag leaf area index. The genotypes like Indian-6, BM-726, P-10-2013 and Johar-2013 showed the good performance in terms of fresh biomass and the days to 50% flowering. Ninety four genotypes were selected out of 208 genotypes of sorghum on the basis of biomass-related traits and subjected under extensive genotyping by using SSR marker system. Chromosome 6 was genotyped by 23 polymorphic SSRs, while 19 SSRs were used for genotyping of chromosome 9. Structure analysis yielded four admixture subpopulations with the help of 20 unlinked markers. Seven markers trait associations (MTAs) were noticed through mixed linear model approach and phenotypic variability ranged from 9.13 to 13.9% for chromosome 6 and 6.25 to 23.05% for chromosome 9. The marker Xgap07 was associated with days to 50 % flowering (DTF) and plant height (PH) on chromosome 6. While the markers SB3789 and Xtxp265 exhibited association with leaf length and plant height, respectively on

chromosome 6 for the two growing seasons. The SSR primer Xtxp283 showed association with two different traits plant height and days to 50% flowering and SB5040 was found to be associated with leaf length on chromosome 9. The present study provided novel QTLs for biomass-related traits (plant height, days to 50% flowering and leaf length) which can be utilized for marker assisted breeding for better biomass production in sorghum.

Dr. Muhammad Asif Shehzad

Assistant Professor, Department of Agronomy, MNS-UAM gave an oral talk on the topic "Seed priming with molybdenum regulates physiological processes to improve maize fodder yield under drought stress". He briefly explained that Drought incidence is a major widespread climatic disaster that severely limits the livestock feed production worldwide. The increased risks of water scarcity on food productivity of livestock hence, needs effective approach to counteract its various drastic effects to ensure high yield of fodder crops mainly in climate sensitive areas of the world. Molybdenum (Mo) is considered to induce drought tolerance in crops, however, understanding of Mo-induced improvement in physiological processes for increased fodder production remains elusive. Influence of Mo supply on physiological mechanisms has been reported to increase the maize fodder productivity under water deficit conditions. A pot study was conducted to grow the plants in natural conditions. One set of pots was kept as control (100% field capacity), whereas drought stress (60% field capacity) was imposed in other set. The effect of Mo seed priming (25, 50, 75, 100, 125 mM) including hydro-priming was investigated on growth and physiological processes of maize seedlings exposed to normal and drought stress conditions. Imposed drought stress conditions significantly decreased the green fodder yield, water contents, chlorophyll contents and photosynthetic characteristics of maize plants. Nonetheless, Mo seed priming at 75 mM showed more positive gain in leaf Ψw which resulted in increased relative water contents. Furthermore, Mo seed priming markedly improved the shoot length, root length, shoot and root dry weights as compared to hydro-priming under conditions of drought stress. A significant improvement in net assimilation rate, transpiration rate, stomatal conductance and chlorophyll contents was observed with seed priming treatments under drought stress than normal conditions. It is conclude that Mo seed

priming is an effective approach to improve the productivity of maize fodder in areas of limited water availability.

Session 2. Crop Management for Sustainable Production: Fodder Breeding for Improving Yield and Quality

Venue: Seminar Hall MNS University of Agriculture, Multan

Chair: Dr. Jeffery A. Dahlberg Co-chair: Dr. Khaled M. Bali

Dr. Khaled M. Bali, Statewide Irrigation Water Management Specialist, University of California-Division of Agriculture and Natural Resources gave an oral talk on "On-farm water conservation water management for efficient irrigation of fodder crops". He was of the view that functional markers (FMs) are the most valuable markers for crop breeding. Low cost and high-throughput genotyping for FMs could provide an excellent opportunity to effectively practice marker-assisted selection in breeding. Based on FMs, he developed and validated competitive allele specific PCR (KASP) assays for genes that underpin economically important traits in bread wheat including adaptability, grain yield, quality, and biotic and abiotic stress resistances. Finally, a KASP platform with a robust marker toolkit for high-throughput and cost-effective screening of 90 functional gene/loci in wheat was developed. He further described the three advantages of KASP platform (1) high-throughput, 1536 cultivars can be genotyped with 142 available markers in 2-3 days; (2) low-cost, 9 cents USD per data point including DNA extraction; (3) good quality, highly consistent with normal PCR markers. He emphasized that KASP could be a potential application in wheat breeding to accelerate the characterization of crossing parents and advanced lines for marker-assisted selection of known genes. In addition, they have also developed new 55K and 15K wheat SNP arrays, and a targeted genotyping-by-sequencing (GBS) platform. Such genotyping platforms have significant potential to apply for academic wheat research and applied breeding.

Ms. Fizza ghauri, M.Sc. (Hons) Plant Breeding and Genetics, University of Agriculture, Faisalabad gave an oral talk on "Water Stress Tolerant Oat Selection Criteria Development". She was of the view that Lack of effective selection criteria for water stress tolerance conditions is the key issue that hinders the progress of resistant cultivars against drought. The basic objective of this research was formulation of selection criteria based on seedling traits and drought tolerance indices under normal and two water stress treatments i.e. 1) 50% water of the control and, 2) 25% water of the control. For this purpose, 11 genotypes of oat (*Avena*

sativa L.) were evaluated. The experiment was conducted in two factor factorial completely randomized design (CRD) with three replications in experimental area of Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad. At seedling stage data recorded on various seedling growth parameters, association among the morphological and physiological characters and direct and indirect effects of these characters on dry shoot weight was determined by estimation of genotypic and phenotypic correlation coefficients and path coefficients. For recognition of water stress tolerant genotypes, water stress tolerance indices were calculated. Genetic variability for all the traits were shown by the results. Based on the stress levels and mean performance, stress susceptibility indices, stress tolerance indices and TOL. Oat genotypes F-0301, F-415, and F-403 were recognized as highly water stress tolerant, whereas, F-406 and F-408 were moderately water stress tolerant. Root length, shoot length, net photosynthesis rate, stomatal conductance and leaf temperature were identified as important traits as indicated by the results of correlation and path analysis. These identified traits may be used as a basis of effective selection criteria for breeding programme under water stress conditions.

Ms. Sania Ashraf, Student of Msc (Hons) seed science and technology Department of Plant Breeding and Genetics University of Agriculture, Faisalabad gave an oral talk on "Genetic Variability in Sorghum (*Sorghum bicolor* L.) Germplasm for Green Fodder Yield and Quality Traits". She described that Livestock is a promising sub-sector of agriculture which contributes 56% of total agriculture value added and 11.8% of GDP. For the betterment of livestock, sufficient and nutritious feed is required. Fodder is a cheap source to feed the livestock. Pakistan due to poor germplasm and diseases occurring in fodder crops faces low fodder production which limits the livestock production. Breeders are making efforts to enhance the fodder production to feed livestock. Sorghum, a fodder crop, is grown throughout Pakistan and is highly nutritious. It is leading fodder crop after berseem. Due to its high value in livestock feed, research was conducted to assess the genetic variability in yield and yield-related traits among 20 sorghum accessions. These accessions were grown in the experimental fields of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad under randomized complete block design. In the breeding material the traits like flowering, plant height, the number of leaves, leaf area, moisture content, green forage yield, brix value and leaf/stem ratio were observed. Accessions SGP-27 and SGP-32 were the best performing for number of leaves, plant height, leaf area, leaf/stem ratio and green forage yield. The phenotypic variances and coefficient of variability showed higher values than the genotypic coefficients.

This showed that the environmental effect on the development of variability although the magnitude was not so high. The results of the correlation analysis revealed that genotypic correlation coefficients gave higher value in contrast to the phenotypic ones for most of the traits indicating that these traits were under genetic control with no contribution of the environment. The days of flowering had a maximum positive effect on the yield, the important indirect effects on fodder yield were observed for the number of leaves via plant height and leaf area.

Ms. Kiran Hassan, Student of Msc (Hons), Department of Plant Breeding and Genetics, University of\ Agriculture, Faisalabad gave an oral talk on "Genetic variability in the effect of seed weight on seedling, relative growth rate and fodder yield related traits in sorghum accessions". She was of the view that Demand of sorghum is increasing day by day, so it is necessary to make efforts for the development of high green forage yielding sorghum. Therefore, the present study was conducted to determine the effect of seed weight on seedling traits, relative growth rate, green forage yield and its components. Research was carried out in two experiments. The first experiment was conducted using completely randomized block design with three replications. Data were recorded 21, 28 and 35 days after sowing for emergence percentage, emergence rate index, root length, shoot length fresh root weight, fresh shoot weight, fresh total weight, dry root weight, dry shoot weight, root/shoot ratio and relative growth rate of five plants per accessions per replication. The second experiment was carried out in field and data were recorded for quantitative traits i.e. leaf area, plant height, number of leave per plant, leaf/stem ratio and green forage yield. Data were analyzed statistically to determine genotypic and phenotypic association and genetic variability. Genotypic correlation coefficients were non-significant for all the traits but higher in magnitude as compared to phenotypic coefficients. Seed weight had maximum positive direct effect on green forage yield followed by dry shoot weight and leaf area. Fresh root weight ratio had maximum indirect effect via dry shoot root weight ratio. The traits like fresh root weight, root shoot length ratio, seed weight and plant height can be used for improvement of green forage yield in sorghum.

Ms. Fazila Ramzan, Student of Msc (Hons), Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad gave an oral talk on "Variability and interrelationship of various traits in fodder sorghum (Sorghum bicolor L.)". She was of the view that among the developing countries, Pakistan is one where milk and meat availability is short and human population is increasing at faster rate (3% annually) than the milk production. Livestock population is increasing, but in Pakistan fodder shortage still is the limiting factor for livestock production. Therefore, investigated study was carried out to overcome the issue of fodder shortage. Forty-eight forage sorghum accessions were

obtained from National Fodder Research Programme, National Agricultural Research Centre, Islamabad and evaluated in seedling experiment. The experiment was conducted in metallic trays filled with fresh river sand to record the data on seedling traits. Genetic variation among the accessions was observed for seedling traits. Fresh shoot weight, dry shoot weight, fresh root weight and dry root weight had high heritability and were under the control of additive gene action. Correlations among all the seedling traits under study were positive and significant except correlations of relative growth rate with fresh root weight and dry root weight\ which were positive and non-significant. The results of present study suggested that the accessions may be used to develop high yielding forage sorghum varieties by\ exploiting their genetic variability.

Mr. Nabeel Ikram, Lecturer Department of Agronomy, MNS-University of Agriculture Multan. He gave an oral talk on the topic "Weed-crop interference affects quality of maize fodder". He was of the view that drought stress adversely affects the Maize (*Zea mays* L.) is the extensively cultivated fodder crop in Pakistan and provides succulent palatable and high tonnage of green fodder. Weeds cause significant reduction in yield, palatability and nutritive value of fodders. Evaluation of critical weed control period is important to ensure high yield and quality of fodders. Therefore, a field study was conducted at Agronomic research Area, University of Agriculture Faisalabad to determine the effects of weed competition on fodder maize with different weed competition period (zero competition, competition for 2 weeks after emergence (WAE), competition for 3 WAE, competition for 4 WAE, competition for 5 WAE and competition for full season) were considered. The maximum number of weeds (201.81) plants m-2 was recorded when weed compete with maize fodder for 5 WAE. The more leaves per plant (17.12), green fodder yield (75.71 t ha-1), dry matter yield (18.02 t ha-1), crude protein (9.21%) were recorded when maize fodder was kept weed free throughout the growing season, while maximum crude fiber (37.42 %) was recorded when weeds were allowed to compete with maize fodder throughout the growing season. In conclusion, weeds must be controlled till four weeks of crop emergence for better maize fodder production with seed rate of 125 kg ha- maximum crude fiber (37.42 %) was recorded when weeds were allowed to compete with maize fodder throughout the growing season. In conclusion, weeds must be controlled till four weeks of crop emergence for better maize fodder production with seed rate of 125 kg ha-1.

CONCLUDING SESSION

Distribution of Souvenir

Field Visit 12AH Makhdoompura Road Khanewal (27-03-2019)

Foreign delegate visited the farms of Mr. Rana Yasin (progressive farmer) with Dr. Sarmad Frogh Arshad and Dr. Mudassar Yasin. The farmer community looked so excited to found fodder and forage experts among them. Firstly the farmer community of 12 AH village welcomed the delegate very warmly. Then they visited the fields and asked many practical questions to the foreign delegate. The eminent scientist told them that preferable bailing should be done at late night because proper moisture is needed for this practice. They further emphasized on the pH profiling of the soil for to get maximum production. Delegate suggested nodulation test by uprooting the plant to check or to estimate the strength of plant and the field. They said that rhizoshpere portion of the plant is really important for the proper growth and maximum production. They further stressed to the farmer community to maintain the proper moisture level for the optimum growth of alfalfa and to get maximum output from the market. The delegate was moved back to the MNS-University of Agriculture, Multan.

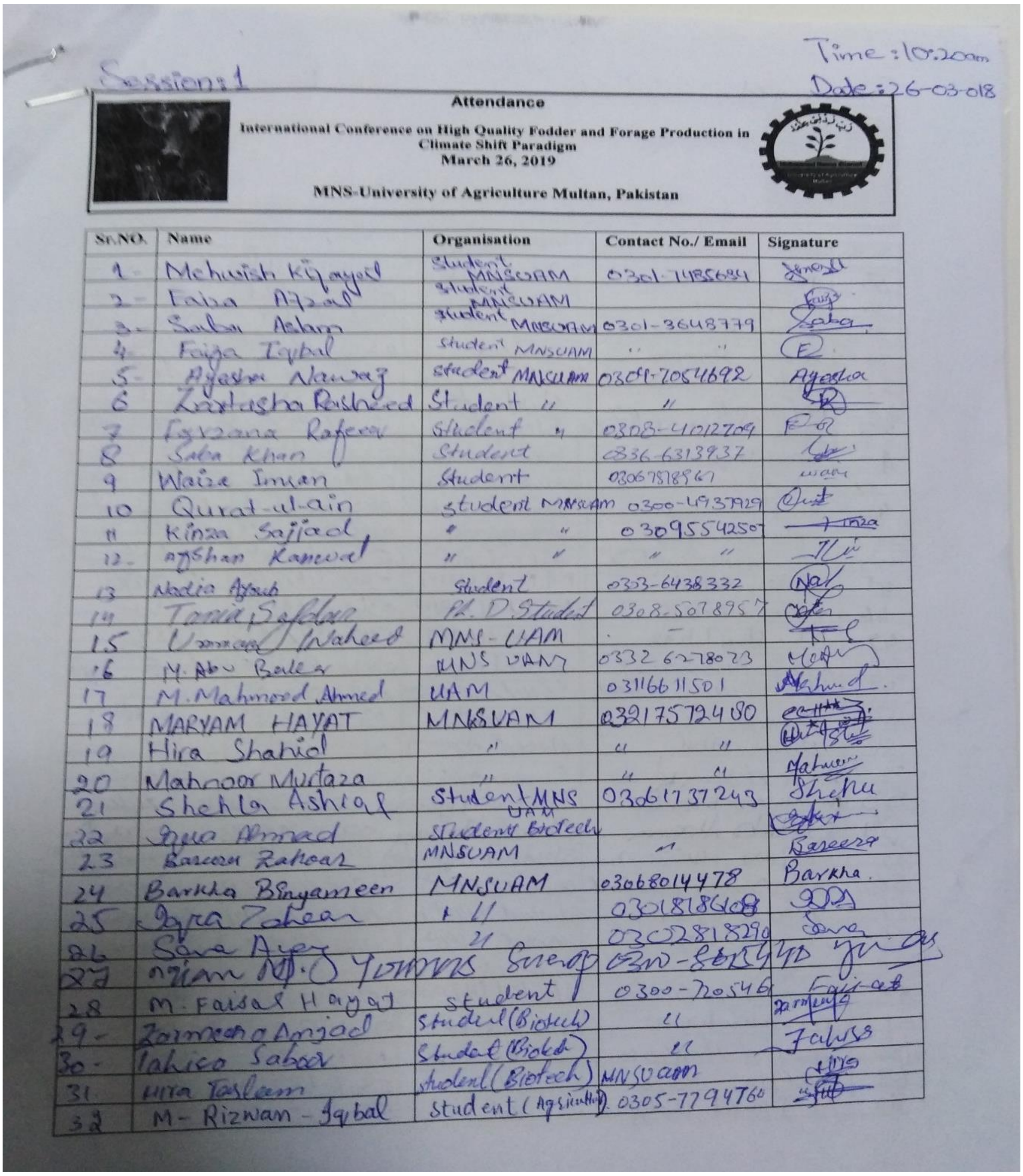
Field Visit 12AH Makhdoompura Road Khanewal








LIST OF THE PARTICIPANTS



Session: 1

Time: 10:20am

Date: 26-03-018

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm

March 26, 2019

MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./ Email	Signature
1	Mehwish Kiyayat	Student MNSUAM	0301-7485684	[illegible]
2	Faiza Afzal	Student MNSUAM		[illegible]
3	Saba Aslam	Student MNSUAM	0301-3648779	Saba
4	Faiza Iqbal	Student MNSUAM	" "	(F)
5	Ayesha Nawaz	Student MNSUAM	0304-7054692	Ayesha
6	Zartasha Rasheed	Student "	"	[illegible]
7	Farzana Rafeeq	Student "	0308-4012709	[illegible]
8	Saba Khan	Student	0336-6313937	[illegible]
9	Waiza Imran	Student	03067878967	[illegible]
10	Qurat-ul-ain	student MNSUAM	0300-4937929	[illegible]
11	Kinza Sajjad	" "	03095542507	Kinza
12	Afshan Kanwal	" "	" "	[illegible]
13	Nadia Ayoub	Student	0333-6438332	[illegible]
14	Tania Safdar	Ph.D Student	0308-5078957	[illegible]
15	Usman Waheed	MNS-UAM	-	[illegible]
16	M. Abu Baker	MNS UAM	0332 6278023	[illegible]
17	M. Mahmood Ahmed	UAM	03116611501	Mahmud
18	MARYAM HAYAT	MNSUAM	03217572480	[illegible]
19	Hira Shahid	"	" "	[illegible]
20	Mahnoor Murtaza	"	" "	Mahnoor
21	Shehla Ashraf	Student MNS UAM	03061737243	Shehla
22	Iqra Ahmad	Student Biotech		[illegible]
23	Baseera Zahoor	MNSUAM	"	Baseera
24	Barkha Binyameen	MNSUAM	03068014478	Barkha
25	Iqra Zaheer	"	03018186108	[illegible]
26	Sara Ayaz	"	03022818290	Sara
27	Anjum M.O Younas	Sureng	0300-8653440	[illegible]
28	M. Faisal Hayat	student	0300-70546	Faisal
29	Zarmeena Amjad	Student (Biotech)	"	Zarmeena
30	Tahira Saboor	Student (Biotech)	"	Tahira
31	Hira Tasleem	student (Biotech)	MNSUAM	Hira
32	M- Rizwan - Iqbal	Student (Agriculture)	0305-7794760	[illegible]

Session # 01

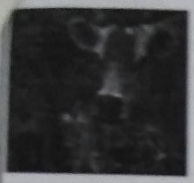
Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./ Email	Signature
33	Ali Hassan	Student	0304-2867194	
34	M. Faheem	Student	0346-0017127	
35	Sadam Hussain	Student	0303-0707109	
36	Hassan Nawaz	Student	0305-7858699	
37	Ashir Tareen	0//	0306-0174782	
38	M Faisal	Student	0301-5555908	
39	M. Adeel Khan	Student	0321-7895566	
40	M. Waqar Hassan	Student (IPB)	0304-4130905	
41	M. Azaq	Student	0306-1912802	
42	M. Rauf Shah	Student (IPB)	0305-4818571	
43	M Ashraf	Student	0307-8153998	
44	M. SHAHZAD	MNSUAM	0301-4074437	
45	Hassan Askri	M.N.SUAM	0307-4672124	
46	Zain Abbass	M.N.SU.AM	0340-1268572	
47	M. Shahbaz	M N SUAM	0302-5776835	
48	Ijaz Hussain	Student	0346-8463078	
49	M. Younus. Khan	Student MNSUAM	0332-0600631	
50	Rashid Ali	Student	0307-8173183	
51	Usman Abid	Student Agronomy	0300-7218597	
52	Ameer Ahmad	Student [illegible]	302-3622230	
53	M. Waseem Meer	Student. Agronomy	0305-5396254	
54	Saqib Aleem	Student. Agronomy	0323-7[illegible]	
55	Sajdar Hussain	Student Agronomy	0300 7366[illegible]	
56	M Numan Khalid	Student (IPB)	0308-4264372	
57	HM waqas	Student (IPB)	0304-2264747	
58	Inam ullah	Student (IPB)	0306-8883811	
59	M. Azam Khan	Student (Plant Pathology)	0340-7151995	
60	Hafiz Abdul Qudoos	Student (Agronomy)	0303903914	
61	M. Nadeem	Student (PP)	0304-7373655	
62	Jadid Hassan	Student (IPB)	03165977[illegible]	
63	Sufyan Raza	11	0308-6378-57	
64	M. Jumad Shahzad	11	0301 117039	

Session #01



Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./ Email	Signature
65	M-Zia-ur-Rehman	Student (PPI)	03024439988	
66	M. Wasim Shafjad	" PBG	0334-7837844	
67	Muhammad Riaz Nasir	PBG	0334-6081840	
68	Amcar Hamza	MSc(Hons) S.S.T	0308-9068066	
69	M. Khalid	MSc(Hons) SST	0345 6294787	
70	Saeed ch	SST	—	
71	Abdul Manoor	SST	—	
72	Attiq-UY-Rehmman	MSc(Hons) S.S.T	03457379027	
73	M. Hasnain	MSc(Hons) PBG	0301-7587137	
74	Naveed Zaman	" "	0313-9884141	
75	Fatima Sajjad	M.Phill Biotech		
76	Muhammad Ashfaq	S.O. CRS. BWP	0301-7772379	

Time: 10:30

Session #01

Date: 26-03-018

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./ Email	Signature
1-	Adnan Iqbal	MSc (Hons)	0304-0126833	
2-	Farooq Ahmad	Student (MNSc)	-	
3-	Maaz Anwar	MANS-UAM	0303-5096	
04	Sanwal Mumtaz	MNSUAM	03467707558	
05	Muhammad Zeeshan	MNSUAM	0300-6770543	
06	M. Afaq Khalid	MNSUAM	0307-4799445	
07	MArslan	MNSUAM	0304-3133114	
08	M Usman	MNSUAM	0306-9300431	
09	Wajiha Khan	MNSUAM	-	
10	M Zeeshan Zafar	MNSUAM	0304-3040111	
11	M Rehan Asghar	"	[illegible]	
12	Hassan asghar	"	0304-7414021	
13	Waqar Hassan	"	0333-7081215	
14-	M Sohan Hussain	"	03049519450	
15-	M. Zahid	MNS-UAM	0303-3695221	
16	M. Waseem Akbar	MNS-UAM	0300-9770765	
17	KHURSHEED Ahmed Dhaun	MNSUAM	0307-7765567	
18	Muhammad Shafqat	MNSUAM-	0304-7765147	
19	Muhammad Zubair	MNSUAM	0346-5703523	
20	Abid Rasool	MNSUAM	03076178927	
21	Ali Raza	MNSUAM	03047500748	
22	Zahid Iqbal	MNSUAM	03069032693	
83	Shahbaz Rana	MNSUAM	0349[illegible]007	
24	Nudasir Khan	MNSUAM	0342-9321036	
25	Hamza Bashir	MNSUAM	0308-6375648	
26	Mohsin Adeel	MNSUAM	0306-1032364	
87	Muhammad Arif	MNSUAM	03000434860	
28	Zain-ul-Shahid	MNSUAM	03018945854	
29	Faisal JALEEL	MNSUAM	0308-8623	
30	Mr. Umar Saeed	"	0341-0618386	
31.	M. Zubair	MNSUAM	0303-8774947	

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./ Email	Signature
32	Mohammed Sajid	MNSUAM	0305-4142639	
33	Saif-ur-Rehman	MNSUAM	0315-7531825	
34	M. SHAHZAD	MNSUAM	0301-6079435	
35	M. Faizan	MNSUAM	0308-0683778	
36	Muhammad Bilal	MNSUAM	0303-7833878	
37	Zeeshan Muhammad	MNSUAM	0301-5282425	
38	Malik Waqar Yousaf	PBG - MNSUAM	0315-4662882	
39	Shoaib Hassan	SST. MNSUAM	0309-7806255	
40	Fahad Bhutta	SST. MNSUAM	0310-6818382	
41	Wasim Atiq	MNSUAM (IPB)	0302-7864079	
42	Ghulam Mustafa	MNSUAM (IPB)	0306-5653116	
43	Hafiz M. Awais	MNSUAM (IPB)	0302-9892754	
44	Muhammad Yasin	MNSUAM (IPB)	0333-2135728	
45.	M. Faheem Zafar	MNSUAM	0302-7055655	
46	Imran Haider	MNSUAM	0304-5823406	
47	M. Fahad Javed	MNSUAM	0300-4160177	
48	Khurram Ali	MNSUAM	0333-4166114	
49	M. Sufyan Arshad	MNSUAM	0303-7171999	
50	M. Faisal Nadeem	"	03067550615	
51	Hafiz Muzamil Raza	MNSUAM	0306-5513772	
52	Khawaja Mazahir	" "	0308-7486525	
53	M Saeed	" "	03106635538	
54	Husnain Hameed	"	0302-6619956	
55	Bahram Khan	UAF	0321-8239050	
56	Zuhaib Khalid	MNS-UAM	0301-7159314	
57	Mudassir Mehmood	MNS-UAM	0320-3005024	
58	M. Sufiyan	MNS-UAM	0342-0307580	
59	M. Zulkifl	MNS-UAM	0302-8989860	
60	M. Irfan Ahmed	MNS-UAM	0304-7709267	
61	M. Faisal	"	0306-0728396	
62	M Zain	"	"	
63	Naved Raza	"	0344-7273244	

Session #01

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./ Email	Signature
64	M-Zia-ur-Rehman	Student	0302-4439988	
65	M. Azam Khan	Student	0340-7151997	
66	M. Nadeem	Student	0304-7373655	M. Nadeem
67	Sultan Raza	4	0308-6378057	
68	M. Junaid Shahzad	11	03011703971	
69	Ameer Hamza	IPBB (Student)	0308-9068046	Ameer Hamza
70	M. Shahid	IPBB Student	0305-6294787	
71	Bilal Mansoor	Student	0307-5907176	Bilal
72	M. Waseem Akram	Student (MNSc)	0303-6702073	
73	Raz* Nawaz	BZU	0320-0634192	
74	Hamid Akbar	B.Sc (BZU)	03136142626	
75	FARHAN ABID	B.Sc BZU	0301-3190420	
76	M. Umer Hanan	BSC BZU	0302-7475089	
77	M. AMMAR RAFIQUE	BSC BZU	0331-8689777	
78	Muhammad Ammar	BSc BZU	0316-8575404	
79	M. Ali Umer	B.Sc BZU	0341-4888881	
80	M. Zeeshan	B.Sc BZU	0307-2719850	
81	Anwar	MPhil BZU	041-612920	
82	Asif-ur-Rehman	B.Sc BZU	0308-7083019	
83	Afaq Aslam	B.Sc BZU	0301-5481620	
84	Nasir Qadir	BSc (Hons) BZU	0302-7688661	
81	Abdul Kayheed	BSc (Hons) BZU	0303-6602059	
82	M. Javaid Iqbal	BSC (Hons) BZU	0304-7226491	
83	M. Abid	BSc (Hons) BZU	0301-4949671	
84	Abusufyan	BSc (Hons) BZU	0341-0049790	
85	Wasif Javed	B.Sc (Hons) BZU	0308-2684947	
86	Wajid Munir Qureshi	B.Sc (Hons) BZU	0306-7308846	
87	Ihsan Ilahi	B.Sc (Hons) BZU	0306-5171311	
88	Abdul Ahad	B.Sc (Hons) BZU	0312-5865569	
89	Abid Hussain	B.Sc (Hons) BZU	0304-8643913	
90	Hamza Bin Saeed Lodhi	BSC (Hons) Agri	03333863322	
91	M. Asif Mansoor	MSc (Hons) IPBB	asifmansoor1997@gmail.com	

Session: 02

Time: 1:20 pm
Date: 26-03-2018

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./ Email	Signature
1	Faqir Nusrat Hussain		0333707670	N Hussain
	Malik Naseer Malta		03009630773	[illegible]
	Rasheed Sindhu	Malik	03030708099	[illegible]
	DR F. H. Anjum	Agronomist, Agronomic Res. Station Karor	0301-6090603	[illegible]
	DR. RAO WALI MUHAMMAD	PARC	03226169212	[illegible]
	Col. Dr. Amir Alam	CMH-Rup	0334-5001857	[illegible]
	Izaz Hassan Gardizi	Agri/Dairy Farm	0300-8635612	[illegible]
	Malik M. Rafique Bhutta	Agri-Farm	0301-7435335	[illegible]
	Dr. Asif SHEHZAD	MNSUAM	0334-6059373	[illegible]
	Malik HUMAYUN	Farmer/Dairy farmer	0304-1202920	[illegible]
	Dr. Unsar Naeem-Ullah	MNSUAM	0300-6358808	[illegible]
	Dr Ali Bakhsh	Ghazi University	03356893312	[illegible]
	Dr. Fahim Nawaz	MNS-UAM	03352293739	[illegible]
	M. Farukh Zafar Khan	MNS-UAM	03065510843	[illegible]
	Dr Muqarrab Ali	"	03006752257	[illegible]
	Kamran Hussain	"	03366642564	[illegible]
	Saddam Hussain	MNS-UAM	0341-3484614	[illegible]
	FAHAD RASHID	UAF	–	[illegible]
	Sajjad Bashir	MNS-UAM	0300-2141431	[illegible]
	Abusufyan	BZU	0341-004979	[illegible]
	Hamza Ahmad Qureshi	MNSUAM	0309-5200099	[illegible]
	M. Waseem Akram	MNSUAM	0303-6707073	[illegible]
	M. Usman Sami	~~MNS~~UAF	03346944467	[illegible]
	Bahram Khan	UAF	0321-8239050	[illegible]
	Hammad Afzal	BZU	0334-1646140	[illegible]
	Babar Islam	B.Z.U	0321-7876198	[illegible]
	M. Mudasir	B.Z.U	0349-1718234	[illegible]
	M. Zeeshan	MNSUAM	0300-6770543	M. Zeeshan
	Saif-ur-Rehman	"	0315-7531825	[illegible]
	M. Sajid	"	0305-4142639	[illegible]
	Muhammad Ammar	BZU	0316-8575404	Ammar
	Mirza M. Ahad Baig	"	0302-7758969	[illegible]

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

Sr.NO.	Name	Organisation	Contact No./Email	Signature
1	Saad Zafar	BZU	0304-9435290	
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3	Sadia Shabir	MNSUAM	—	
4	Rabia Shabir	MNSUAM	—	
5	M. SHAHZAD	MNSUAM	0301-4079435	
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7	Zeeshan Muhammad	MNSUAM	[illegible]	
8	Khawaja Mazahir	MNSUAM	0304-7458615	
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10	Muhammad Aziz	MNSUAM	0305-3572043	
11	M. Rehan Ashraf	MNSUAM	[illegible]	
12	M. Zeeshan Zafar	MNSUAM	0341-0578471	
13	M. Afaq Khalid	"	0314-8253421	
14	Fahad Bhutta	MNSUAM	[illegible]	
15	M Amir Bakhtiyar	MNSUAM		
16	Noman Iqbal	MNSUAM	[illegible]	
17	Zulfiqar Ali Rahujo	ARI Bahawalpur	03332314704	
18	Dr. M. Ijaz	PARC, PARC BARDC	03425164329	
19	Dr. M. Abid	MNSUAM	0313-6969184	
20	Sidra Rasheed	MNSUAM	—	

Session #02

Date: 26-03-2019

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

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1	Saba Aslam	Student MNSUAM	0301-3648779	
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6-	H.M. Waqas	IPB Student	0304-2204747	
7	Imran ullah	IPB Student	0306-6863811	
8	Javaid Hassan	PP student	0301-6597	
9	M. Jamil Shahzad	PP Student	0305	
10	Usman Khan	PH-D Student	0902-1122374	
11	Anas Khan	M. Phill Student	0311-6129	
12	Ghulam Mustaza	BSc Agriculture	0308-7259	
13	M. Javaid Mavis	B.Sc Agriculture	0304-7226	
14	Abdul Rasheed	BSc (Hons)	0303	
15	M Abid	B.Sc (Hons) BZU	0301-696957	
16	Farhan ABID	B.Sc BZU	0301-3190420	
17	M. Umer Hamza	BSC BZU	0302-7475	
18	Hamid Akbar	BSc BZU	0336/0342826	
19	Zeeshan ul Hassan	BSc BZU	0307271988	
20	M. Rauf Shah	B.Sc (Hons) PBG MNSUAM	0305-4918551	
21	Zain Abbas	BSC (Hons) PBG 6th	0340-1685122	
22	Hassan Askari	BSc (Hons) PBG 6th	0307-4672124	
23	M. Waqas Hassan	BSc (Hons) PBG (6th)	0304-4136405	
24)	Dr. Salman	A. Prof (PBG)	—	
25	Wajiha Khan	BSc hons (PBG 6th)	0304-7835255	
26-	Waiza Imran	BSc. hons PBG 6th	0306-7518967	
27	Bisma	MPhill Biotech		
28	Bareera Zahoor	"	" "	
29	Barkha Binyameen	M.Sc Biotech	—	
30	Tahira Sabaar	M.Sc Biotech	—	
31	Muhammad Ashfaq	S.O CRS BWP	0301-7772319	
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International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

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37	Abdul Mannan	8PB	03345035280	
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Session #02

Date: 26-03-018

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

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6	Dr. M. Asif Saleem	"	0333-6197488	
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10	Tamir Safdar	MNSUAM	0308-5078957	
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18	Waiza Imran	MNSUA Student	03326278073	waiza
19	Wajiha Khan	MNSUA Student	03326278073	
20	Sidra Asghar	" "		Sidra
21	Sara Ahmad	" "		Sara
22	Areej Fatima	" "		Areej
23	Noor-ul-ain	" "		
24	M. Adnan Hussain	"	03046919450	
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MNS-University of Agriculture Multan, Pakistan

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35	Shahbaz Ashraf	"	0341-8063040	
36	Shahmeer Sajid	"	0308-6828608	
37	Ayesha Siddiqa	"	03129663030	
38	Mawora Mustafa	"	0307131937	
39	M. Adnan Sabir	BZU Multan	0304-8568470	
40	Hamza Ali khan	BZU	0304-9326370	
41	Muhammad Ali	BZU	0304-8607359	
42	Abdul Ahad	BZU	03125865569	
43	Chaudry Ehsan Elahi	BZU	03065171311	
44	Raza Nawazish	BZU	~~~	
45	Asif Mansoor	UMSUAM	~~~	

Time: 03:20

Date: 26-03-2019

Session #03

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm

March 26, 2019

MNS-University of Agriculture Multan, Pakistan

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4.	Numan Khalid	MNSUAM	0308-4264322	
5.	H. Waqas	MNSUAM	0304-2264247	
6.	Ghulam Mustafa	MNSUAM(IPB^2)	0306-5693116	
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12.	Saima Rasheed	"	—	
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14	M. Abu Bakar		03326278022	
15	Fatima Gulzar	MPhill Biotech	—	Fatima Gulzar
16.	Bareera Zahoor	MPhill Biotech	—	Bareera.
17	Bisma Riaz	" "	—	Bisma.
18	Nadia Ayub	MSc PBG MNSUAM	0303-6438332	
19	Ayesha Nawaz	M.Sc (Hons) IPB^2	0304-7054892	Ayesha
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Session#03

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
March 26, 2019

MNS-University of Agriculture Multan, Pakistan

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3	Sadia Shabir	MNSUAM	"	[illegible]
4	Rabia Shabir	MNSUAM	"	[illegible]
5	Muhammad Sajid	MNSUAM	0305-4142639	[illegible]
6	M. Usman Sami	UAF	03346944467	[illegible]
7	Bahram Rahi	UAF	0321-8239050	[illegible]
8	M Mehsir Khan	MNSUAM	0332-8538972	[illegible]
9	Dr. Asif SHEHZAD	MNSUAM	0334-6039373	[illegible]
10	Dr. M. Salman	"	0334698035	[illegible]
11	Mahmood Alam Khan	"	0300 6884448	[illegible]
12	Muqadas Ali	"	03136184844	[illegible]
13	Umair Saeed	"	. . . .	[illegible]
14	Ahmad Hassan	"	0301-2608926	[illegible]
15	FAHAD HASSAN	UAF	03123132939	[illegible]
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21	Waqas Hayder	MNSUM	"	[illegible]
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24	Muhammad Bin Mushtaq	MNSUAM	—	[illegible]
25	Saba Aslam	MNSUAM	—	Saba
26	Waseem Shehzad	MNSUAM	—	[illegible]
27	Hira Tasleem	MNSUAM	—	[illegible]
28	Zarmeena Amjad	MNSUAM	—	[illegible]
29	Sabiha Riaz	MNSUAM		sabiha.
30	Sadia Hakeem	MNS-UAM.	03376148552	Sadia
31	Zarmeena Amjad	MNSUAM	"	Zarmeena
32	Salwah Merrium	MNSUAM	.	Salwah

Session #03

Attendance

International Conference on High Quality Fodder and Forage Production in Climate Shift Paradigm
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MNS-University of Agriculture Multan, Pakistan

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اویس رؤف

جلد 1 | 19 رجب المرجب 1440ھ 27 مارچ 2019ء 15 چیت 2076ب | شمارہ 336 | صفحات 12 | قیمت 20 روپے

کانفرنس سے ڈاکٹر آصف علی، ڈاکٹر ڈینیل، ڈاکٹر جنفری اے ڈھلبرگ اور ڈاکٹر خالد معیاری چارہ کی پیداوار کے حوالے سے خطاب کر رہے ہیں

کسانوں کو چارہ کی پیداوار میں مزید رہنمائی دینگے: ڈاکٹر آصف

لوسرن پر امریکی تحقیق کو مدنظر رکھ کر بہترین نتائج حاصل کر سکتے ہیں: ڈاکٹر ڈینیل و دیگر

ملتان (خصوصی رپورٹر) وائس چانسلر بہاؤالدین زکریا یونیورسٹی کے شعبہ پلانٹ بریڈنگ اینڈ جینیٹکس کے زیر اہتمام انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فارنج پروڈکشن ان کاٹی میٹ شفٹ کا انعقاد کیا گیا۔ کانفرنس سے خطاب میں وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی نے کہا کہ انٹرنیشنل کانفرنس منعقد کروانے کا بنیادی مقصد علاقے کے کسانوں اور زمینداروں کی فی کس آمدن میں اضافہ کرنے کیلئے اقدامات کرنا ہے۔ ہم کسانوں اور زمینداروں کو چارہ کی پیداوار کیلئے مزید بھی رہنمائی کرینگے۔ سیمینار سے خطاب کرتے ہوئے ڈاکٹر ڈینیل پلنم، ڈاکٹر جنفری اے ڈھلبرگ اور ڈاکٹر خالد ہالی و دیگر نے جانوروں کے متبادل چارہ جات لوسرن کی پیداوار کے حوالے سے امریکہ میں کی جانے والی ریسرچ اور ماڈل پیش کیا اور بتایا کہ اس ماڈل اور ریسرچ کو مدنظر رکھ کر پاکستانی کسان اور زمیندار چارہ جات کی پیداوار کے بہترین نتائج حاصل کر سکتے ہیں۔ سیمینار سے پاکستانی زرعی سائنسدانوں نے بھی خطاب کیا، اس موقع پر ممبر پبلک سروس کمیشن لاہور سید ابن حسنین، ممتاز خان منیس، ڈاکٹر عرفان احمد بیگ، ڈاکٹر شفقت سعید، ڈاکٹر ذوالفقار علی موجود تھے۔

قسم ھے قلم کی اور جو کچھ لکھتے ھیں ، القرآن

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ملتان، اسلام آباد، رحیم یار خان، لاہور، کراچی، مظفر آباد، پشاور، فرینکفرٹ، لندن اور گلگت بلتستان سمیت دنیا کے تیز ترین بڑھنے والا اردو اخبار

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چیف ایڈیٹر: مہتاب خان

ایڈیٹر: محسن بلال خان

بدھ 27 مارچ 2019ء، 19 رجب المرجب 1440ھ، 14 چیت 2076ب، صفحات 12 قیمت 20 روپے

17 سال

شمارہ: 222

ملتان: ایم این ایس زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس ویک کے دوران منعقدہ انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فارمج پروڈیکشن ان کلائی میٹ شفٹ کے حوالے سے مقررین خطاب کر رہے ہیں

کسانوں اور زمینداروں کو چارہ جات کی پیداوار کیلئے مزید بھی رہنمائی کرینگے، ڈاکٹر آصف علی

انٹرنیشنل کانفرنس کا مقصد کسانوں اور زمینداروں کی فی کس آمدن میں اضافہ کیلئے اقدامات کرنا ہے

ملتان (وقائع نگار خصوصی) ایم این ایس زرعی یونیورسٹی کے شعبہ پلانٹ بریڈنگ اینڈ جینٹکس کے زیر اہتمام انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فارمج پروڈیکشن ان کلائی میٹ شفٹ کا انعقاد کیا گیا ۔کانفرنس منعقد کروانے کا مقصد اعلیٰ معیار کے چارہ جات کی زریعے دودھ اور گوشت کی پیداوار کو بڑھانا ہے اور اس کے علاوہ امریکہ میں بہترین چارہ حاصل کرنے کیلئے کئے (باقی صفحہ 4 بقیہ نمبر 45)

جانے والے اقدامات اور تحقیق کو پاکستان میں عام کرنا تھا۔کانفرنس کے مہمان خصوصی ڈاکٹر ڈینیل پٹنم (Denial .Dr Putnam) ڈاکٹر جیفری اے جلبرگ (Jeffery .Dr Dahlberg A) اور ڈاکٹر خالد باجی (امریکہ) تھے۔کانفرنس کا افتتاح کرتے ہوئے وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی نے حاضرین اور مقررین کا کانفرنس میں شرکت پر شکریہ ادا کیا ۔انہوں نے کہا کہ انٹرنیشنل کانفرنس منعقد کروانے کا بنیادی مقصد علاقے کے کسانوں اور زمینداروں کی فی کس آمدن میں اضافہ کرنے کیلئے اقدامات کرنا ہے۔انہوں نے مزید کہا کہ یہاں کے زمیندار دودھ بیچنے پر جانور پالتے ہیں جن کی خوراک کیلئے درپیش مسائل کے حل کیلئے جامعہ نے اس انٹرنیشنل سیمینار کا انعقاد کیا گیا ہے۔انہوں نے کہا کہ ہم کسانوں اور زمینداروں کو چارہ جات کی پیداوار کیلئے مزید بھی رہنمائی کرینگے۔سیمینار سے خطاب کرتے ہوئے ڈاکٹر ڈینیل پٹنم (Denial .D r Putnam) ڈاکٹر جیفری اے جلبرگ (Jeffery .Dr Dahlberg A) اور ڈاکٹر خالد باجی و دیگر نے جانوروں کے متبادل چارہ جات لوسرن کی پیداوار کے حوالے سے امریکہ میں کی جانے والی ریسرچ اور مثال پیش کی اور بتایا کہ اس مثال اور ریسرچ کو مدنظر رکھ کر پاکستانی کسان اور زمیندار چارہ جات کی پیداوار کے بہترین نتائج حاصل کر سکتے ہیں۔اس کے علاوہ انہوں نے متبادل چارہ جات کے بارے میں تفصیلی پریزنٹیشن بھی دی۔انہوں نے دودھ اور گوشت دینے والے جانوروں کیلئے بہترین چارہ جات کے حوالے سے بھی آگاہ کیا۔انہوں نے اپنی تفصیلی گفتگو میں بتایا کہ کس جانور کیلئے کونسا چارہ بہتر ہے اس کے علاوہ انہوں نے جانوروں کی بہترین نشوونما کیلئے چراگاہوں کی بہترین منجمنٹ کے حوالے سے آگاہ کیا۔انہوں نے جانوروں کی تغذائی ضروریات مدنظر رکھتے ہوئے سبز چارہ جات خشک چارہ جات خود ساختہ چارہ جات کے بارے میں بھی بتایا۔سیمینار سے پاکستانی زرعی سائنسدانوں نے بھی خطاب کیا اور چارہ جات کی فصلوں پر تفصیلی پریزنٹیشنز دیں۔اس موقع پر ریزڈ آئی جی ریلوے پولیس و ممبر پبلک سروس کمیشن لاہور سید اظہر حسین، سابق ممبر سٹیٹ بینک آف پاکستان ممتاز خان منیس، ڈاکٹر عرفان احمد بیگ، ڈاکٹر شفقت سعید، ڈاکٹر ذوالفقار علی سمیت جامعہ کے تمام اساتذہ طالبات اور کسانوں کی کثیر تعداد موجود تھی۔

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بانی ایڈیٹر انچیف
میاں عامر محمود

روزنامہ دنیا ملتان

WEDNESDAY, MARCH 27, 2019

جلد نمبر 8 | بدھ 19 رجب المرجب 1440ھ 27 مارچ 2019ء 14 چیت 2076ب | شمارہ 85

رجسٹرڈ نمبر 357 | فون: 061-4540116-9 فیکس: 061-4540107 | صفحات 12 قیمت 20 روپے

ملتان: انٹرنیشنل کانفرنس سے مقررین خطاب کرتے ہوئے

زرعی یونیورسٹی میں کانفرنس کا انعقاد

ملتان (خصوصی رپورٹر) زرعی یونیورسٹی کے شعبہ پلانٹ بریڈنگ اینڈ جینیٹکس کے زیر اہتمام انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فارنج پروڈکشن ان کلائی میٹ شفٹ کا انعقاد کیا گیا۔ وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی نے کانفرنس کا افتتاح کرتے ہوئے کہا کہ کانفرنس کا مقصد اعلیٰ معیار کے چارہ جات کے ذریعے دودھ اور گوشت کی پیداوار کو بڑھانا ہے۔ اس موقع پر ممتاز خان، ڈاکٹر عرفان احمد، ڈاکٹر شفقت سعد، ڈاکٹر ذوالفقار علی و دیگر موجود تھے۔

ہمارے لیے اللہ ہی کافی ہے اور وہی سب سے بہتر مددگار ہے القرآن

ملتان/لاہور/راولپنڈی/اسلام آباد/کراچی/پشاور سے بیک وقت شائع ہونیوالا موثر ترین قومی اخبار فیکس نمبر-4577928 فون نمبر7-4577925

چیف ایڈیٹر: مجیب الرحمٰن شامی

روزنامہ پاکستان ملتان

THE DAILY PAKISTAN MULTAN

ایڈیٹر: عمر مجیب شامی

جلد 15 | بدھ 19 رجب المرجب 1440ھ 27 مارچ 2019ء 15 چیت 2075ب صفحات 12 قیمت 20 روپے | شمارہ 70

ملتان، دودھ، گوشت کی پیداوار بڑھانے کیلئے زرعی یونیورسٹی میں انٹرنیشنل کانفرنس

کانفرنس کا مقصد کسانوں، زمینداروں کی آمدن میں اضافہ، چارہ جات کیلئے رہنمائی کرینگے، وائس چانسلر ڈاکٹر آصف

ملتان (سٹاف رپورٹر) ایم این ایس زرعی یونیورسٹی کے شعبہ پلانٹ بریڈنگ اینڈ جینیٹکس کے زیر اہتمام انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فارمج پروڈیکشن ان کلائی میٹ شفٹ کا انعقاد کیا گیا۔ کانفرنس منعقد کروانے کا مقصد اعلیٰ معیار کے چارہ جات کی زریعے دودھ اور گوشت کی پیداوار کو بڑھانا اور اس کے علاوہ امریکہ میں بہترین چارہ حاصل کرنے کیلئے کیے جانے والے اقدامات اور تحقیق (بقیہ نمبر 36 صفحہ 12 پر)

بقیہ 36

کانفرنس

کو پاکستان میں عام کرنا تھا۔ کانفرنس کے مہمان خصوصی ڈاکٹر ڈینیئل پٹنم (Dr.Daniel Putnam)، ڈاکٹر جیفری اے ڈھلمرگ (Dr. Jeffery A. Dahlberg) اور ڈاکٹر خالد بالی (امریکہ) تھے۔ کانفرنس کا افتتاح کرتے ہوئے وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی نے کہا کہ انٹرنیشنل کانفرنس منعقد کروانے کا بنیادی مقصد علاقے کے کسانوں اور زمینداروں کی فی کس آمدن میں اضافہ کرنے کیلئے اقدامات کرنا ہے۔ انہوں نے مزید کہا کہ زمیندار وسیع پیمانے پر جانور پالتے ہیں جن کی خوراک کیلئے درپیش مسائل کے حل کیلئے جامعہ نے اس انٹرنیشنل سیمینار کا انعقاد کیا گیا ہے۔ انہوں نے کہا کہ ہم کسانوں اور زمینداروں کو چارہ جات کی پیداوار کیلئے مزید بھی رہنمائی کرینگے۔ سیمینار سے خطاب کرتے ہوئے ڈاکٹر ڈینیئل پٹنم (Dr. Daniel Putnam)، ڈاکٹر جیفری اے ڈھلمرگ (Dr. Jeffery A. Dahlberg) اور ڈاکٹر خالد بالی و دیگر نے جانوروں کے متبادل چارہ جات لوسرن کی پیداوار کے حوالے سے امریکہ میں کی جانے والی ریسرچ اور ماڈل پیش کیا اور بتایا کہ اس ماڈل اور ریسرچ کو مدنظر رکھ کر پاکستانی کسان اور زمیندار چارہ جات کی پیداوار کے بہترین نتائج حاصل کر سکتے ہیں۔ اس کے علاوہ انہوں نے متبادل چارہ جات کے بارے میں تفصیلی پریزنٹیشن بھی دی۔ انہوں نے دودھ اور گوشت دینے والے جانوروں کیلئے بہترین چارہ جات کے حوالے سے بھی آگاہ کیا۔ انہوں نے اپنی تفصیلی گفتگو میں بتایا کہ کس جانور کیلئے کونسا چارہ بہتر ہے اس کے علاوہ انہوں نے جانوروں کی بہترین نشوونما کیلئے چراگاہوں کی بہترین مینجمنٹ کے حوالے سے آگاہ کیا۔ انہوں نے جانوروں کی غذائی ضروریات مدنظر رکھتے ہوئے سبز چارہ جات، خشک چارہ جات خود ساختہ چارہ جات کے بارے میں بھی بتایا۔ سیمینار سے پاکستانی زرعی سائنسدانوں نے بھی خطاب کیا۔ اس موقع پر ریٹائرڈ آئی جی ریلوے پولیس و ممبر پبلک سروس کمیشن لاہور سید ذکی حسین، سابقہ ممبر سنڈیکیٹ جامعہ ممتاز خان عیسیٰ، ڈاکٹر عرفان احمد بیگ، ڈاکٹر شفقت سعید، ڈاکٹر ذوالفقار علی سمیت جامعہ کے فیکلٹی، طلباء و طالبات اور کسانوں کی کثیر تعداد موجود تھی۔

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جلد نمبر 45 | بدھ 19 رجب المرجب 1440ھ 27 مارچ 2019ء 13 چیت 2073ب | صفحات 12 | قیمت 15 روپے | شمارہ نمبر 201

ملتان: ایم این ایس زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس ویک کے دوران منعقدہ انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فاریج پروڈیکشن ان کلائی میٹ شفٹ (معیاری چارہ جات کی پیداوار) کے حوالے سے مقررین خطاب کر رہے ہیں

معیاری چارہ جات سے دودھ، گوشت کی پیداوار بڑھانا ہوگی: ڈاکٹر آصف

زرعی یونیورسٹی نے جانوروں کی خوراک کے حوالے سے انٹرنیشنل کانفرنس کا انعقاد کیا ہے

ملتان (آفتاب نیوز) ایم این ایس زرعی یونیورسٹی کے شعبہ پلانٹ بریڈنگ اینڈ جینٹکس کے زیر اہتمام انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فاریج پروڈیکشن ان کلائی میٹ شفٹ کا انعقاد کیا گیا۔ کانفرنس منعقد کروانے کا مقصد اعلیٰ معیار کے چارہ جات کی

باقی صفحہ 9 بقیہ نمبر 50

بقیہ 50

زریعے دودھ اور گوشت کی پیداوار کو بڑھانا ہے اور اس کے علاوہ امریکہ میں بہترین چارہ حاصل کرنے کیلئے کئے جانے والے اقدامات اور تحقیق کو پاکستان میں عام کرنا تھا۔ کانفرنس کے مہمان خصوصی ڈاکٹر ڈینیئل پٹنم (Dr. Denial Putnam)، ڈاکٹر جیفری اے ڈہلبرگ (Dr. Jeffery A. Dahlberg) اور ڈاکٹر خالد بالی (امریکہ) تھے۔ کانفرنس کا افتتاح کرتے ہوئے وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی نے حاضرین اور مقررین کا کانفرنس میں شرکت پر شکریہ ادا کیا۔ انہوں نے کہا کہ انٹرنیشنل کانفرنس منعقد کروانے کا بنیادی مقصد علاقے کے کسانوں اور زمینداروں کی فی کس آمدن میں اضافہ کرنے کیلئے اقدامات کرنا ہے۔ انہوں نے مزید کہا کہ یہاں کے زمیندار وسیع پیمانے پر جانور پالتے ہیں جن کی خوراک کیلئے درپیش مسائل کے حل کیلئے جامعہ نے اس انٹرنیشنل سیمینار کا انعقاد کیا گیا ہے۔ انہوں نے کہا کہ ہم کسانوں اور زمینداروں کو چارہ جات کی پیداوار کیلئے مزید بھی رہنمائی کرینگے۔ سیمینار سے خطاب کرتے ہوئے ڈاکٹر ڈینیئل پٹنم (Dr. Denial Putnam)، ڈاکٹر جیفری اے ڈہلبرگ (Dr. Jeffery A. Dahlberg) اور ڈاکٹر خالد بالی ودیگر نے جانوروں کے متبادل چارہ جات لوسرن کی پیداوار کے حوالے سے امریکہ میں کی جانے والی ریسرچ اور ماڈل پیش کیا اور بتایا کہ اس ماڈل اور ریسرچ کو مدنظر رکھ کر پاکستانی کسان اور زمیندار چارہ جات کی پیداوار کے بہترین نتائج حاصل کر سکتے ہیں۔ اس کے علاوہ انہوں نے متبادل چارہ جات کے بارے میں تفصیلی پریزنٹیشن بھی دی۔ انہوں نے دودھ اور گوشت دینے والے جانوروں کیلئے بہترین چارہ جات کے حوالے سے بھی آگاہ کیا۔ انہوں نے اپنی تفصیلی گفتگو میں بتایا کہ کس جانور کیلئے کونسا چارہ بہتر ہے اس کے علاوہ انہوں نے جانوروں کی بہترین نشوونما کیلئے چراگاہوں کی بہترین مینجمنٹ کے حوالے سے آگاہ کیا۔ انہوں نے جانوروں کی غذائی ضروریات مدنظر رکھتے ہوئے سبز چارہ جات، خشک چارہ جات خود ساختہ چارہ جات کے بارے میں بھی بتایا۔ سیمینار سے پاکستانی زرعی سائنسدانوں نے بھی خطاب کیا اور چارہ جات کی فصلوں پر تفصیلی پریزنٹیشن دیں۔ اس موقع پر ریٹائرڈ آئی جی ریلوے پولیس وممبر پبلک سروس کمیشن لاہور سید ابن حسین، سابقہ ممبر سنڈیکیٹ جامعہ ممتاز خان گیس، ڈاکٹر عرفان احمد بیگ، ڈاکٹر شفقت سعید، ڈاکٹر ذوالفقار علی سمیت جامعہ کے فیکلٹی، طلباء وطالبات اور کسانوں کی کثیر تعداد موجود تھی۔

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پاکستان کے 11 شہروں سے بیک وقت شائع ہونے والا واحد اخبار

جلد 17 شمارہ 222 | بدھ 19 رجب المرجب 1440ھ 27 مارچ 2019ء 13 چیت 2076ب، صفحات 12 قیمت 20 روپے

ملتان: ایم این ایس زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس میں معیاری چارہ جات کی پیداوار کے حوالے سے مقررین خطاب کر رہے ہیں

محمد نواز شریف زرعی یونیورسٹی میں انٹرنیشنل کانفرنس کا انعقاد

کانفرنس کا مقصد چارہ جات کی ذریعے دودھ اور گوشت کی پیداوار کو بڑھانا ہے: وائس چانسلر

ملتان (نامہ نگار) محمد نواز شریف زرعی یونیورسٹی کے شعبہ پلانٹ بریڈنگ اینڈ جینیٹکس کے زیر اہتمام انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فارج پروڈکشن ان کاٹی میٹ شفٹ کا انعقاد کیا گیا۔ کانفرنس منعقد کروانے کا مقصد اعلیٰ معیار کے چارہ جات کی زریعے دودھ اور گوشت کی پیداوار کو بڑھانا ہے اور اس کے علاوہ امریکہ میں بہترین چارہ حاصل کرنے کیلئے کئے جانے والے اقدامات اور (باقی صفحہ 6 نمبر 8)

تحقیق کو پاکستان میں عام کرنا تھا۔ کانفرنس کے مہمان خصوصی ڈاکٹر ڈینئل پلنم، ڈاکٹر جیفری اے ڈھلوگ اور ڈاکٹر خالد باہی (امریکہ) تھے۔ کانفرنس کا افتتاح کرتے ہوئے وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی نے حاضرین اور مقررین کا کانفرنس میں شرکت پر شکریہ ادا کیا۔ انہوں نے کہا کہ انٹرنیشنل کانفرنس منعقد کروانے کا بنیادی مقصد علاقے کے کسانوں اور زمینداروں کی فی کس آمدن میں اضافہ کرنے کیلئے اقدامات کرنا ہے۔ انہوں نے مزید کہا کہ یہاں کے زمیندار وقتاً چارہ پر جانور پالتے ہیں جن کی خوراک کیلئے درپیش مسائل کے حل کیلئے جامعہ نے اس انٹرنیشنل سیمینار کا انعقاد کیا ہے۔ انہوں نے کہا کہ ہم کسانوں اور زمینداروں کو چارہ جات کی پیداوار کیلئے مزید بھی رہنمائی کریں گے۔ سیمینار سے خطاب کرتے ہوئے ڈاکٹر ڈینئل پلنم، ڈاکٹر جیفری اے ڈھلوگ اور ڈاکٹر خالد باہی و دیگر نے جانوروں کے متبادل چارہ جات لوسرن کی پیداوار کے حوالے سے امریکہ میں کی جانے والی ریسرچ اور ماڈل پیش کیا اور بتایا کہ اس ماڈل اور ریسرچ کو مدنظر رکھ کر پاکستانی کسان اور زمیندار چارہ جات کی پیداوار کے بہترین نتائج حاصل کر سکتے ہیں۔ اس کے علاوہ انہوں نے متبادل چارہ جات کے بارے میں تفصیلی پریزنٹیشن بھی دی۔ انہوں نے دودھ اور گوشت دینے والے جانوروں کیلئے بہترین چارہ جات کے حوالے سے بھی آگاہ کیا۔ انہوں نے اپنی تفصیلی گفتگو میں بتایا کہ کس جانور کیلئے کونسا چارہ بہتر ہے اس کے علاوہ انہوں نے جانوروں کی بہترین نشوونما کیلئے چراگاہوں کی بہترین مینجمنٹ کے حوالے سے آگاہ کیا۔ اس موقع پر ریجنل ڈائریکٹر آئی جی ریلوے پولیس، ممبر پبلک سروس کمیشن لاہور سید ابن حسین، سابقہ ممبر سنڈیکیٹ جامعہ ممتاز خان عیسیٰ، ڈاکٹر عرفان احمد بیگ، ڈاکٹر شفقت سعید، ڈاکٹر ذوالفقار علی سمیت جامعہ کے فیکلٹی، طلباء و طالبات اور کسانوں کی کثیر تعداد موجود تھی۔

باقاعدہ تصدیق شدہ اشاعت ABC CERTIFIED پاکستان کے ہر روزنامے سے زیادہ

THE DAILY JANG MULTAN

روزنامہ جنگ ملتان

بانی..... میر خلیل الرحمٰن مجلہ

صفحات 12 قیمت 20 روپے

4547970-73 فون 1110 رجسٹرڈ نمبر

جلد 17 | بدھ 19 رجب 1440ھ 27 مارچ 2019ء 13 چیت 2076ب | شمارہ 91

ملتان : نواز شریف زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس سے مقررین خطاب کر رہے ہیں

زرعی یونیورسٹی کے زیر اہتمام انٹرنیشنل کانفرنس

ملتان (سٹاف رپورٹر) ایم این ایس زرعی یونیورسٹی شعبہ پلانٹ بریڈنگ اینڈ جینیٹکس کے زیر اہتمام انٹرنیشنل کانفرنس کا انعقاد کیا گیا۔ کانفرنس کا مقصد اعلیٰ معیار کے چارہ جات کی ذریعے دودھ اور گوشت کی پیداوار کو بڑھانا اور امریکا میں بہترین چارہ حاصل کرنے کیلئے کئے جانے والے اقدامات اور تحقیق کو پاکستان میں عام کرنا تھا۔ کانفرنس کے مہمان خصوصی ڈاکٹر ڈینیلپشم، ڈاکٹر جیفری اے ڈلبرگ اور ڈاکٹر خالد بالی (امریکا) تھے۔

The Daily 92 News
روزنامہ 92 نیوز
786/92
بانی: میر خلیل الرحمٰن
ملتان
قیمت 20 روپے
صفحات 12
جلد 2
بروز 19 رجب المرجب 1440ھ 27 مارچ 2019ء 14 چیت 2075ب
شمارہ 266

ملتان: ڈاکٹر ڈھنگل پٹنم، ڈاکٹر جیفری اے ڈیلبرگ اور ڈاکٹر خالد باہی، پروفیسر آصف علی و دیگر کانفرنس سے خطاب کر رہے ہیں

چارہ کی پیداوار کیلئے رہنمائی کرتے رہیں گے، پروفیسر آصف علی

ڈاکٹر ڈھنگل پٹنم، ڈاکٹر جیفری اے ڈیلبرگ، ڈاکٹر خالد باہی نے ریسرچ اور ماڈل پیش کیا

ملتان (نمائندہ خصوصی) ایم این ایس زرعی یونیورسٹی کے شعبہ پلانٹ بریڈنگ اینڈ جینیٹکس کے زیر اہتمام انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فارمنگ پروڈکشن ان کوہاٹی میڈ سسٹم کا انعقاد کیا گیا کانفرنس کا مقصد ملکی معیار کے چارہ جات کی ذریعے دودھ اور گوشت کی پیداوار کو بڑھانا ہے اور اس کے علاوہ امریکہ میں بہترین چارہ حاصل کرنے کیلئے کئے جانے والے اقدامات اور تحقیق کو پاکستان میں عام کرنا تھا، وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی نے کہا کہ انٹرنیشنل کانفرنس کروانے کا بنیادی مقصد ملک کے کسانوں اور زمینداروں کی فی کس آمدن میں اضافہ کرنے کیلئے اقدامات کرنا ہے کسانوں اور زمینداروں کو چارہ جات کی پیداوار کیلئے مزید بھی رہنمائی کرینگے، مہمان خصوصی ڈاکٹر ڈھنگل پٹنم، ڈاکٹر جیفری اے ڈیلبرگ اور ڈاکٹر خالد باہی و دیگر نے جانوروں کے متبادل چارہ جات لوسرن کی پیداوار کے حوالے سے امریکہ میں کی جانے والی ریسرچ اور ماڈل پیش کیا اور بتایا کہ پاکستانی کسان اور زمیندار چارہ جات کی پیداوار کے بہترین نتائج حاصل کر سکتے ہیں، انہوں نے جانوروں کی غذائی ضروریات مدنظر رکھتے ہوئے سبز چارہ جات، خشک چارہ جات خود ساختہ چارہ جات کے بارے میں بھی بتایا، سیمینار سے پاکستانی زرعی سائنسدانوں نے بھی خطاب کیا ممبر پبلک سروس کمیشن لاہور سید ابن حسین، سابقہ ممبر سنڈیکیٹ جامعہ ممتاز خان منیس، ڈاکٹر عرفان احمد بیگ، ڈاکٹر شفقت سعید، ڈاکٹر ذوالفقار علی و دیگر موجود تھے۔

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DAILY
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MULTAN

روزنامہ

نوائے وقت

ملتان

بانی حمید نظامی مرحوم
مدیر مجید نظامی مرحوم
ایڈیٹر رمیزہ مجید نظامی

لاہور، کراچی، راولپنڈی/اسلام آباد، کوئٹہ اور ملتان سے بیک وقت شائع ہوتا ہے

جلد	بدھ 19 رجب المرجب 1440ھ 27 مارچ 2019ء 14 چیت 2076ب	صفحات	رجسٹرڈ نمبر سی پی ایل	شمارہ
41	فون 74-4545571 UAN111-222-007 قیمت 20 روپے	12	96	277

Since 1922

اللہ کے نام سے جو بے انتہا مہربان رحم فرمانے والا ہے

O حضرت ابراہیم علیہ السلام نے کہا کہ اللہ کے بھیجے ہوئے فرشتو! تمہارا کیا مقصد ہے O انہوں نے کہا کہ ہم گناہگار قوم کی طرف بھیجے گئے ہیں O تاکہ ان پر مٹی کے کنکر برسائیں O جو تیرے رب کی طرف سے نشان زدہ ہیں ان حد سے گزر جانے والوں کیلئے O پس جتنے ایمان والے تھے ہم نے انہیں نکال لیا O

سورۃ الذاریٰت (آیت: 31 تا 35)

ملتان: ایم این ایس زرعی یونیورسٹی کے زیراہتمام انٹرنیشنل کانفرنس ویک کے دوران مقررین خطاب کررہے ہیں

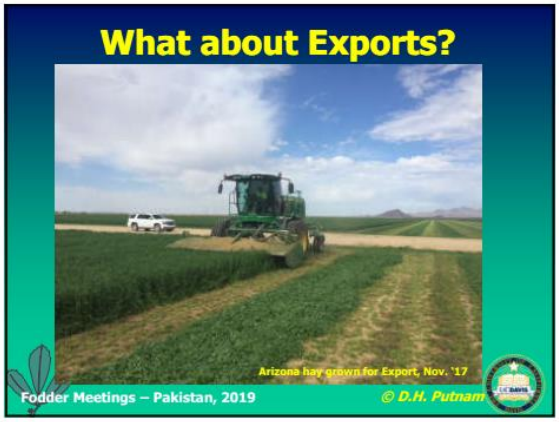
کانفرنس کے انعقاد کا مقصد کسانوں کی فی کس آمدنی میں اضافہ کرنا ہے: ڈاکٹر آصف

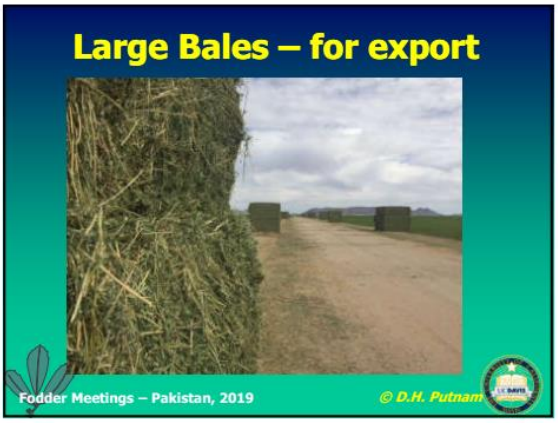
وائس چانسلر زرعی یونیورسٹی کا سیمینار سے خطاب، غیرملکی سائنسدانوں نے امریکی ریسرچ کا ماڈل پیش کیا

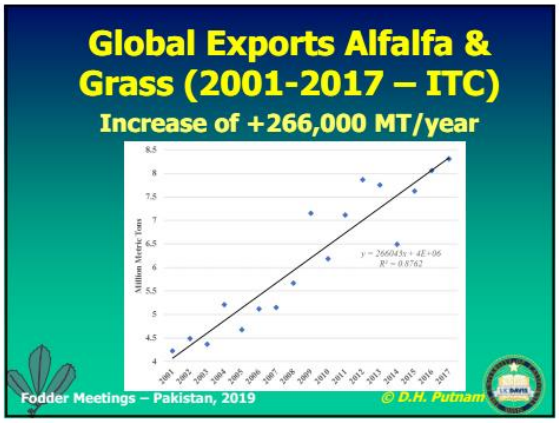
ملتان (نمائندہ نوائے وقت) ایم این ایس زرعی یونیورسٹی کے شعبہ پلانٹ بریڈنگ اینڈ جینیٹکس کے زیراہتمام انٹرنیشنل کانفرنس آن ہائی کوالٹی فاڈر اینڈ فارنج پروڈیکشن ان کلائی میٹ شفٹ کا انعقاد کیا گیا کانفرنس منعقد کروانے کا مقصد اعلیٰ معیار کے چارہ جات کے ذریعے دودھ اور گوشت کی پیداوار کو بڑھانا ہے کانفرنس کے مہمان خصوصی ڈاکٹر ڈینیئل پیٹم ڈاکٹر جیفری اے ڈھلمرگ اور ڈاکٹر خالد باجی تھے کانفرنس کا افتتاح کرتے ہوئے وائس چانسلر جامعہ پروفیسر ڈاکٹر آصف علی نے حاضرین اور مقررین کا کانفرنس میں شرکت پر شکریہ ادا کیا انہوں نے کہا کہ انٹرنیشنل کانفرنس منعقد کروانے کا بنیادی مقصد علاقے کے کسانوں اور زمینداروں کی فی کس آمدن میں اضافہ کرنے کے لئے اقدامات کرنا ہے سیمینار سے خطاب کرتے ہوئے ڈاکٹر ڈینیئل پیٹم ڈاکٹر جیفری اے ڈھلمرگ اور ڈاکٹر خالد باجی و دیگر نے جانوروں کے متبادل چارہ جات لوسرن کی پیداوار کے حوالے سے امریکہ میں کی جانے والی ریسرچ اور ماڈل پیش کیا۔

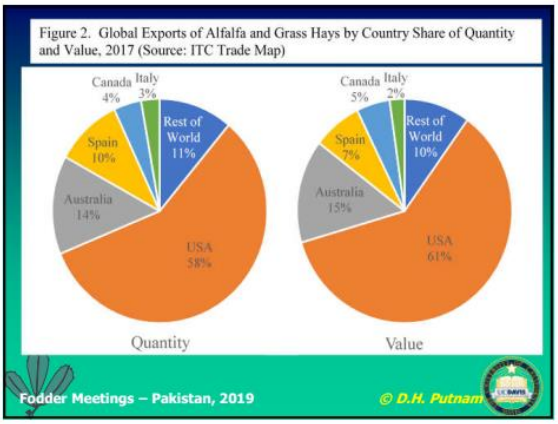
PRESENTATIONS OF EMINENT SCIENTISTS

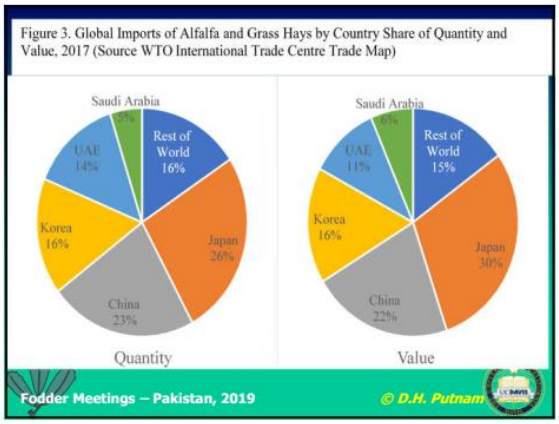
1- Prof. Dr. Daniel Putnam











Export Product Mix (USA)

50%	Alfalfa		Timothy	11%
7%	Perennial Ryegrass		Annual Ryegrass	2%
11%	Fescue		Orchardgrass	1%
1%	Bentgrass		Klein	4%
9%	Sudangrass		Bermuda	4%

(Source: USFEC, Bill Plourd)

US Alfalfa Exports:

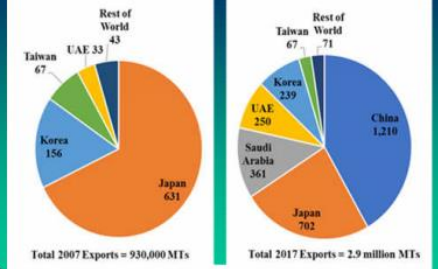
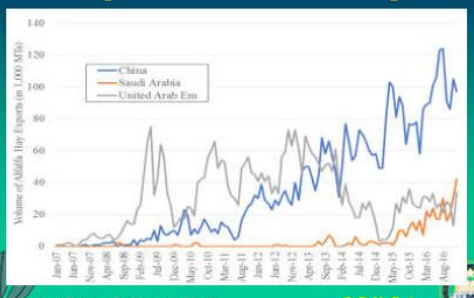


Figure 5: Volume of US alfalfa Exports by Destination 2007 and 2017. Total grass and alfalfa exports exceeded 5 MMTs (2017).

Fodder Meetings – Pakistan, 2019 © D.H. Putnam

Growth Markets for US Exported Alfalfa Hay



Fodder Meetings – Pakistan, 2019 © D.H. Putnam (Source: US Dept. Commerce)

Saudi Dairying

Fodder Meetings – Pakistan, 2019 © D.H. Putnam

Saudi Situation

- Leading Mid-East Milk Producer
- Millions of farm animals
  - Dairy cows, goats, sheep, camel
- Have curtailed (2016-2019) alfalfa & grass hay production due to water limitations
- Market for imported hay between ~1 million MT/year – 4.7 mMT/year
- Illustrates that WATER is our main consideration

Fodder Meetings – Pakistan, 2019 © D.H. Putnam

Long Distance Transport

- Compression Systems
- Containerized Shipping
- Inland shipping largest impediment

Fodder Meetings – Pakistan, 2019

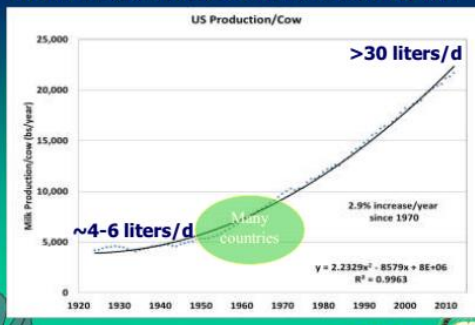
Some Political Implications (March 25, 2019)

What are the keys for Pakistan?

- Take a 'market-driven' approach
- Domestic Market most important
- Driving Force (Dairy) – High Producing Dairy Cows
  - There must be a market for quality forage
  - Milk is the economic engine
  - Water is the primary limiting resource
  - Combinations of alfalfa, berseem, corn/sorghum, misc. forages with concentrates produce the most milk

Dairy Drives Alfalfa!

Phenomenal increase in Production/cow



Why Such Increase in Dairy Production Per cow?

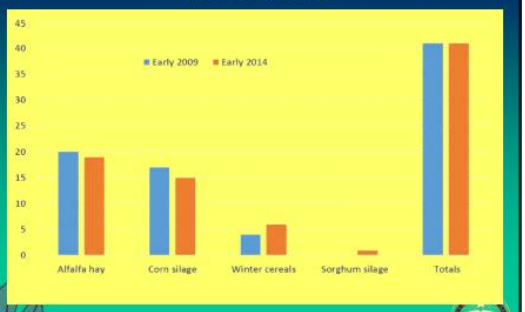
- Improved Bovine Genetics
- Better Dairy Management
  - Cow Comfort/Veterinary
  - Culling Rates (currently very high)
  - Milking strategies (e.g. 3x)
- Better Feeding Strategies
  - High Quality Alfalfa Hay/Silages
  - Concentrated Feeds/Grains/byproducts
  - Scientific Ration Balancing

Not just production, but markets

Fodder Meetings – Pakistan, 2019

Inclusion of forages (%) in high group dairy rations

(Peter Robinson, UCD)



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Envisioning High Yield/High Quality Alfalfa/forage Systems for Pakistan

- Linked to high level dairy production
  - Envision a 'system' – animal & forage
  - All forages (alfalfa, corn silage, sorghum)
- Many Management Factors
  - Agronomic Practices, Varieties
  - Irrigation management
  - Weed and pest management
- Learn from international experiences
- But formulate unique Pakistani solutions
  - Small and large producer

Thinking about Maximum High Quality Alfalfa Yields

- We know yields are sometimes (often?) disappointing
- What keeps our farms from achieving maximum yield?

Fodder Meetings – Pakistan, 2019 © D.H. Putnam

What is the yield gap?

- Difference between on-farm yields and potential yield for a region.
- Common in all crops, differences are often 2x to 3x!

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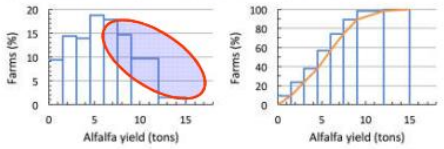
3.4 MT/ha California, 2012, all alfalfa **33.6 MT/ha**

	Less than 1.5	1.5 to 3	3 to 4.5	4.5 to 6	6 to 7.5	7.5 to 9	9 to 12	12 to 15	More than 15
Number	725	68	104	101	136	129	106	70	11	--
Percentage		9%	14%	14%	19%	18%	15%	10%	2%	



Farms in each column had yields no more than the highest number

Michael Russelle, USDA

Analysis of Yield Gap

- What is implicated?
  - Variety?
  - Irrigation?
  - Pest Management
  - Soil Fertility?

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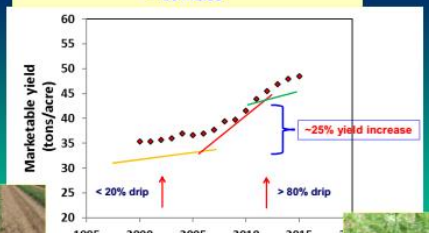
Effects of the drip irrigation revolution - tomato

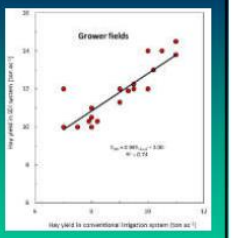


Rolling 5-year average yield:

Pakistan, 2019 © D.H. P

Are these yield improvements possible with alfalfa ?

- Yield Increases appear real with superior irrigation (such as SDI)
- Confirmed by controlled studies (Lamm et al. 2012, UC studies)
- Growers report approximately 3.1 t/a improvement over flood.
- 20-35% range
- Why is that?



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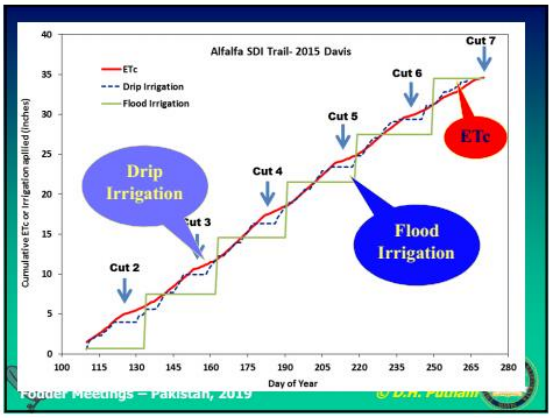

Economics of Variety Choice

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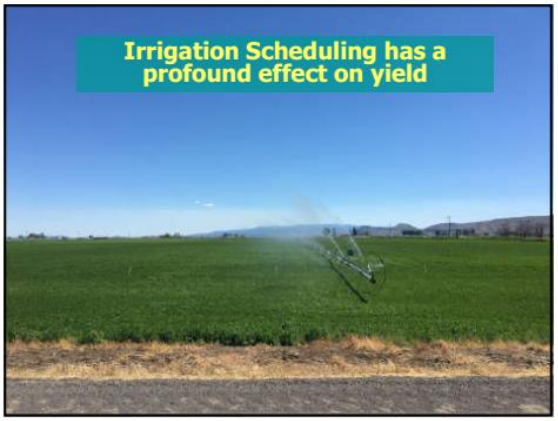


Water

- Key Limiting Facts for Yield
- Logistical constraints are important
- Short term droughts
  - Irrigation System Limits
  - Harvest Schedule Limits
- We likely under-irrigate our crop regularly for maximum yields
- Harvest Schedules and quality needs are major limits

Pest Management

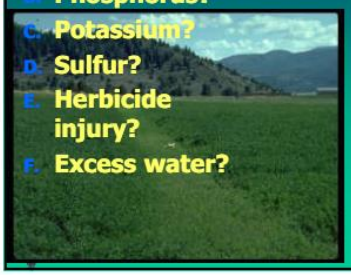
- Effects on stand longevity & yield
  - Diseases
  - Nematodes
  - Gophers
- Weeds actually may increase yields but affect stand
- Failure to control insects

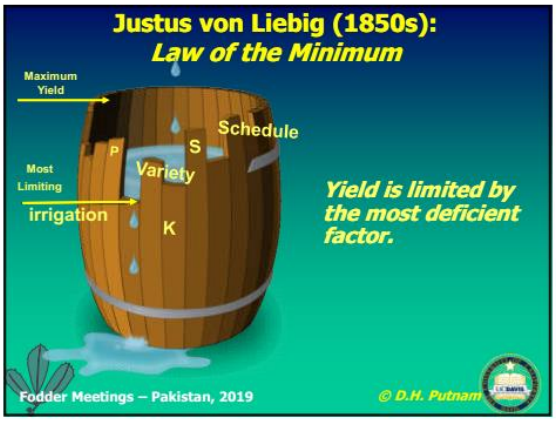
Soil Factors

- Soil Fertility:
  - Likely <20% of growers regularly monitor and test for adequate fertility
  - Soil and plant monitoring
- Mitigating Soil limitation
  - Drainage
  - Salinity

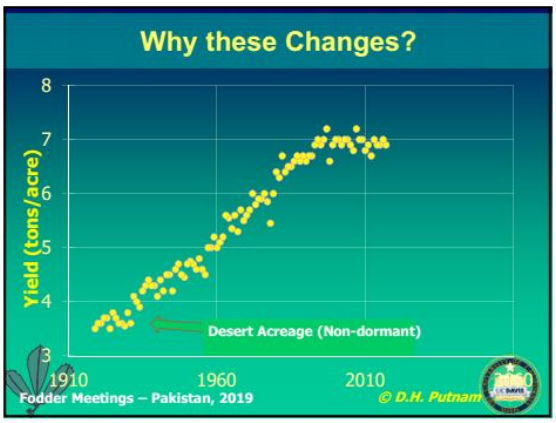
Is this problem…

A. Nitrogen?
B. Phosphorus?
C. Potassium?
D. Sulfur?
E. Herbicide injury?
F. Excess water?




Justus von Liebig (1850s):
Law of the Minimum
Maximum Yield
Most Limiting
irrigation
P
S
Schedule
Variety
K
Yield is limited by the most deficient factor.
Fodder Meetings – Pakistan, 2019
© D.H. Putnam


Where have we been? (Ave. CA yields)
Yield (tons/acre)
8
7
6
5
4
3
1910
1930
1950
1970
1990
2010
Fodder Meetings – Pakistan, 2019
© D.H. Putnam


Why these Changes?
Yield (tons/acre)
8
7
6
5
4
3
Desert Acreage (Non-dormant)
1910
1960
2010
Fodder Meetings – Pakistan, 2019
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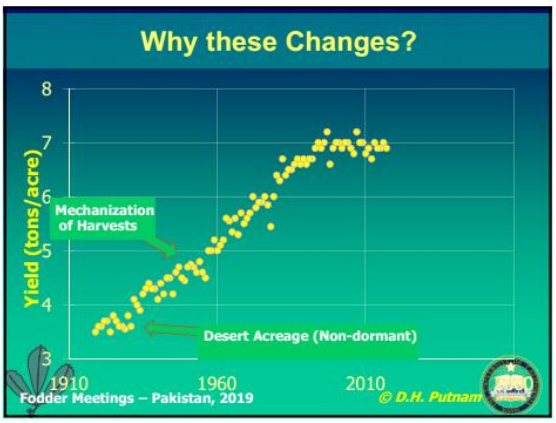
Why these Changes?
Yield (tons/acre)
8
7
6
5
4
3
Mechanization of Harvests
Desert Acreage (Non-dormant)
1910
1960
2010
Fodder Meetings – Pakistan, 2019
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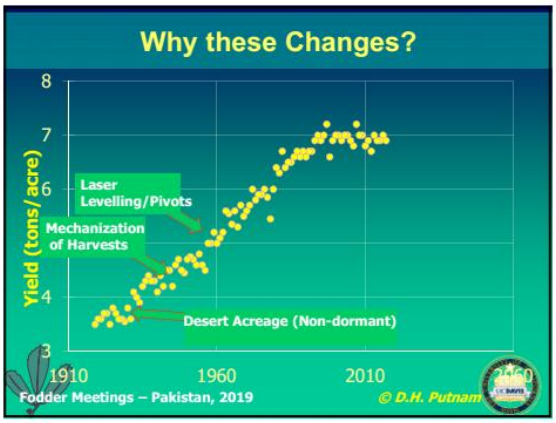
Why these Changes?
Yield (tons/acre)
8
7
6
5
4
3
Laser Levelling/Pivots
Mechanization of Harvests
Desert Acreage (Non-dormant)
1910
1960
2010
Fodder Meetings – Pakistan, 2019
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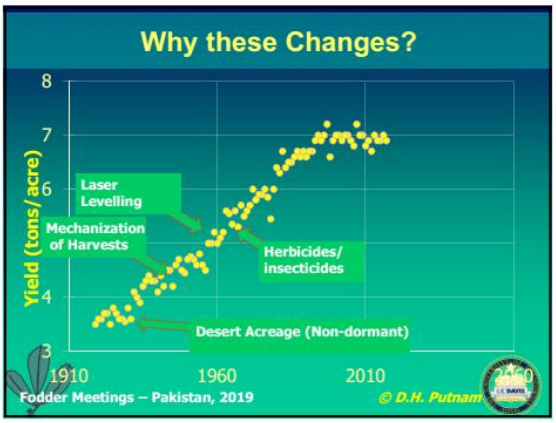
Why these Changes?
Yield (tons/acre)
8
7
6
5
4
3
Laser Levelling
Mechanization of Harvests
Herbicides/ insecticides
Desert Acreage (Non-dormant)
1910
1960
2010
Fodder Meetings – Pakistan, 2019
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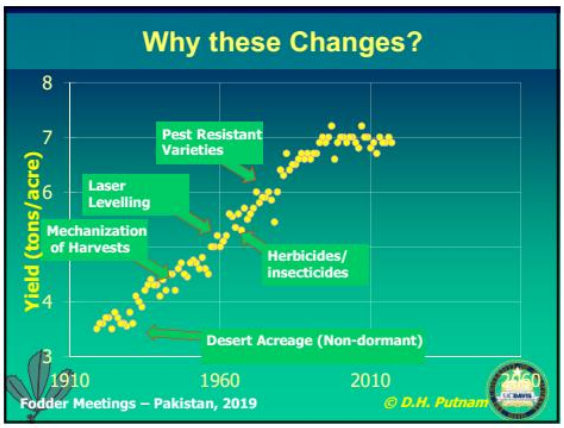
Why these Changes?
Yield (tons/acre)
8
7
6
4
3
1910
1960
2010
Pest Resistant Varieties
Laser Levelling
Mechanization of Harvests
Herbicides/ insecticides
Desert Acreage (Non-dormant)
Fodder Meetings – Pakistan, 2019
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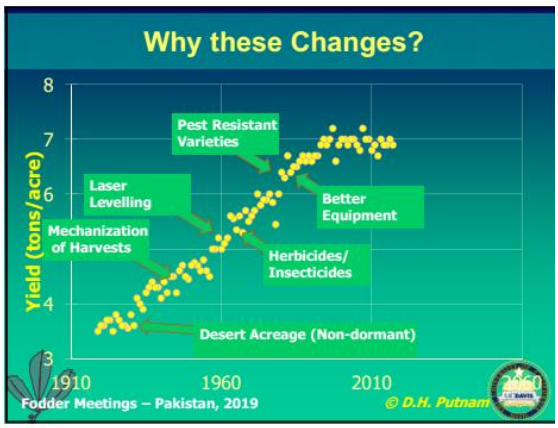
Why these Changes?
Yield (tons/acre)
8
7
6
4
3
1910
1960
2010
Pest Resistant Varieties
Laser Levelling
Mechanization of Harvests
Better Equipment
Herbicides/ Insecticides
Desert Acreage (Non-dormant)
Fodder Meetings – Pakistan, 2019
© D.H. Putnam


The Alfalfa Yield Gap:
It's important
It's worth a lot of $$
What is holding us back?


In my view
Critical Factors for alfalfa:
Advanced Irrigation Systems (technology, Management)
Harvest Scheduling and skill (timing, technique)
Agronomic Practices (Soil Fertility, Stand establishment)
Preservation of quality
Weed Management (dodder, other)
Advanced varieties
Fodder Meetings – Pakistan, 2019
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Key Strategies for Pakistan (scientific strategies)
Concentrate on high yields first
People working on water/irrigation systems improvement for forages
People working on silage/harvesting Systems (both large and small farmers)
People working on weed/pest Management
Comprehensive variety adaptation (breeding later)
Agronomic practices (fertility, management)
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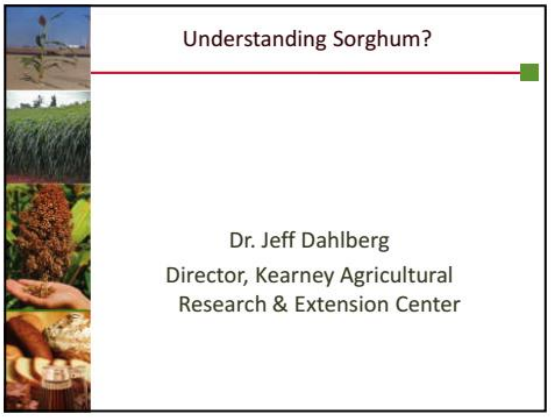
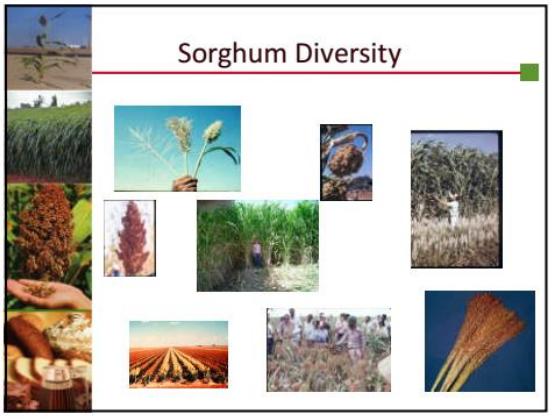
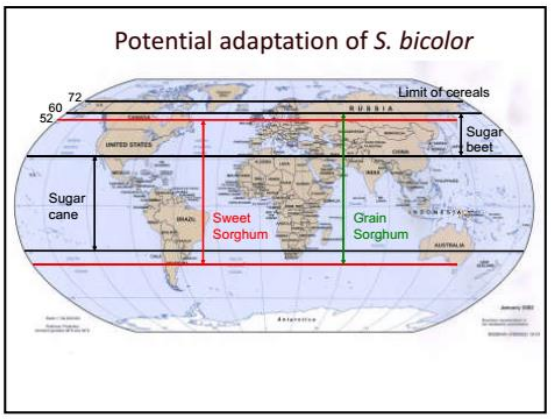
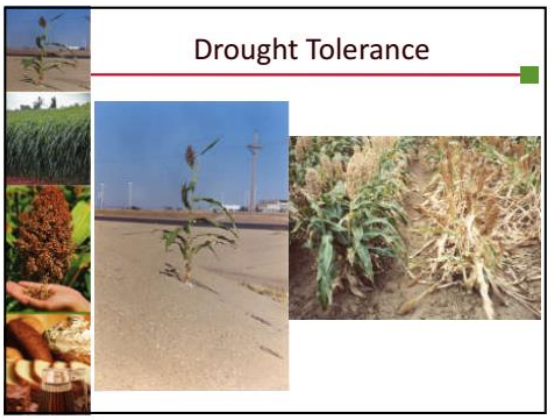
© D.H. Putnam

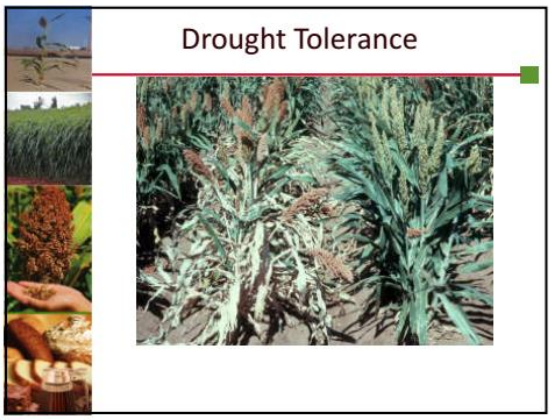
2- Dr. Jeffery A. Dahlberg







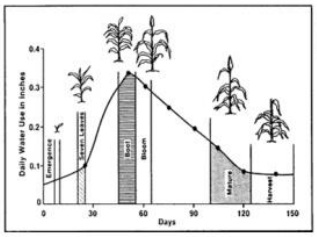




Stay-Green

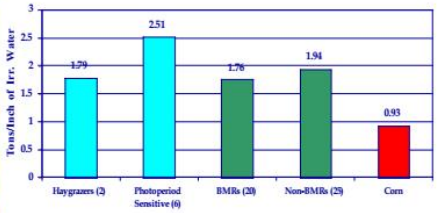
- B35
- Selecton from a BC_1F_2 conversion population of IS 12555
- Drought tolerance and disease resistance

Grain Sorghum Water Use



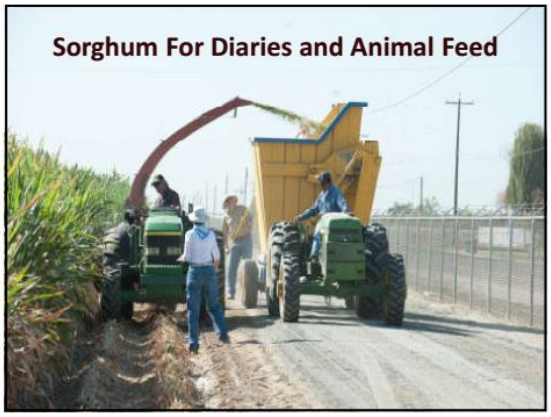
8.2. *Daily use of water by grain sorghum from planting to maturity.*

2001 Irrigated Sorghum Silage Tons Produced per Inch of Irrigation



Irrigation
Sorghum – 13.2 inches
Corn – 28 inches

Sorghum For Diaries and Animal Feed

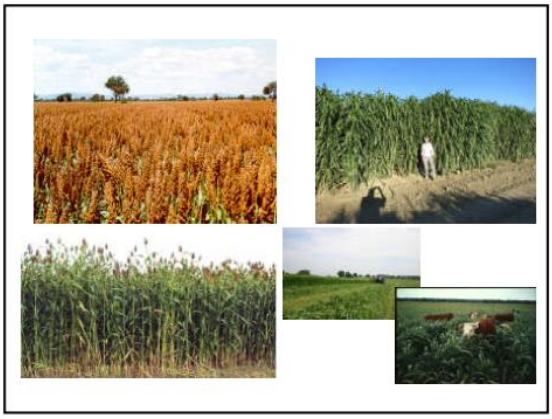


Sorghum is Not Corn!!

- Grain is smaller
  - Processing is different
- Forages are not the same as grain
- Different agronomic practices to optimize yields
  - Require less water and fertilizer
  - Shorter growing season
- Different nutritional qualities which require different feed strategies
  - PS sorghum have no grain
  - Dual purpose sorghums need to be harvest at correct time or need the grain processed
  - Bmr have high digestibility, lower lignin

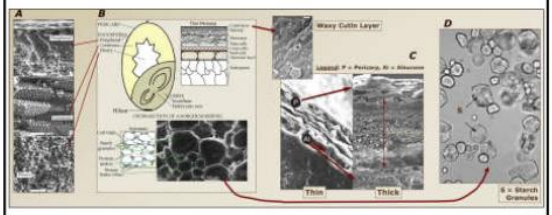
Types of Sorghum

- Grain sorghum primarily a starch source
  - Cracked, dry-rolled, ground, steam-rolled, grinding, or pelleting
- Forage Sorghum
  - Green chopped, ensiled
- Sudan Sorghums
  - Grazed, baled for Hay

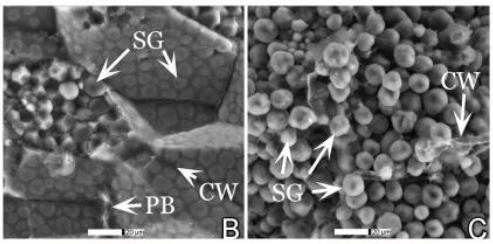


Grain Sorghum

Overview- Sorghum Structure



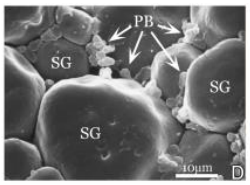
Hard and Soft Endosperm

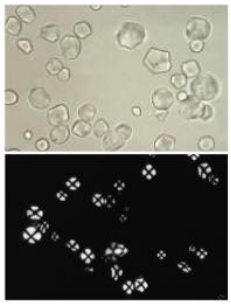


Hard, translucent

Soft, opaque

Starch Granules





Under polarized light, intact starch displays the Maltese Cross

Sorghum Starch

- Can be harder to digest
- Needs to be processed so that animal can fully utilize
- Needs a bit more management!

Types of Processing

- Grind
- Rolling
- Steam-rolled
- Steam flaked
- Pelletizing

Steamed Flaked Corn vs Sorghum

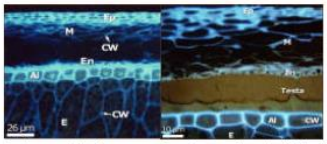
Item	SFS	SFC	P value
Dry matter intake, lb per day	57.1	57.6	0.82
Milk, lb per day	80.5	81.4	0.84
Protein, %	2.96	3.00	0.58
Protein, kg	2.38	2.43	0.71
Fat, %	3.19	3.11	0.45
Fat, kg	2.56	2.51	0.81
Total track starch digestion, %	98.6	97.9	0.86

Steam-flaked sorghum to a density of 28 lb bu^{-1}
Steam-flaked sorghum to a density of 28 lb bu^{-1}
Adapted from Threurer et al, 1999

Tannins in Grain Sorghum

- All commercial grain sorghum hybrids in U.S. are free of tannins
- Can cause some nutritional issues
  - Inhibit some protein uptake
  - Bitterness causes less feed intake

Tannins in Sorghum



Fluorescence photomicrograph of cross-section of a non-tannin (left) and a tannin (right) sorghum kernel. (Adapted from Earp 2004).

The presence of the testa layer is controlled by $B_1\_B_2\_$ genes. When $B_1\_B_2\_$ is dominant, a pigmented testa is present. Sorghum without a pigmented testa does not contain tannins.

Quick Screen for Tannins in Sorghum

Chlorox Bleach Test of non-tannin and tannin sorghums.

Sorghums for Hay

Sudan and Sorghum x Sudan Hybrids

What you Need to Know

- Multi cuts and uses
- Used for providing fiber and fodder through Hay, Haylage, and Grazing
- Can have nutrition issues if handled improperly
  - HCN or Prussic Acid
  - Nitrate issues

Cows like Newer BMR Sudans

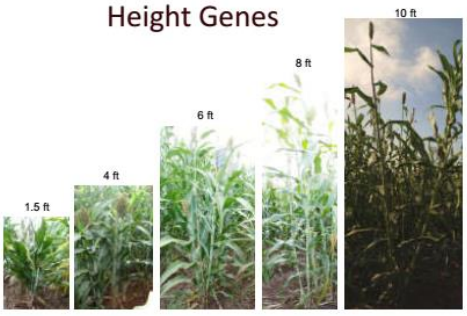
What is Forage Sorghum?

- Hybrid Forage Sorghum-used for silage, green chop

What Makes Forage Sorghums Different?

- Seed industry has been developed around forages
- Hybrids have been specifically bred for forage quality
- Introduction of novel genes for improvement

Height Genes



Photoperiod and Maturity Genes

bmr Genetics

BMR Quality

Type	CP (%)	ADF (%)	NDF (%)	Lignin (%)	IVTD (%)
BMR	9.2	27.6	45.9	3.6	81.3
Range	6.9-10.5	24.3-35.0	40.7-60.1	2.8-4.5	75.1-84.2
Non-BMR	8.3	29.9	49.1	4.4	75.5
Range	6.3-10.8	21.3-41.7	33.9-67.5	2.7-6.4	60.9-83.6
Corn	9.0	23.9	41.2	3.5	82.7

From Bean et al., 2001. Quality parameters of BMR and non-BMR sorghum and corn grown in Bushland, Texas USA.

Issue with some bmr forages

New Genetics

- Brachytic genes
  - Shortens internode length
- Has potential to resolve lodging issues with bmr forages

Lessons to be Learned

- Plant populations, not pounds per acre are necessary
- Managing N fertility is important
  - Different for Forage and Grain!!
- Sorghum forages can be both high yielding and good quality
- Sorghum forages can be managed on less water than most other crops

Bottom Line: Sorghum is Not Corn!!

- Grain is smaller
  - Processing is different
- Forages are not the same as grain
- Different agronomic practices to optimize yields
  - Require less water and fertilizer
  - Shorter growing season
- Different nutritional qualities which require different feed strategies
  - PS sorghum have no grain
  - Dual purpose sorghums need to be harvest at correct time or need the grain processed
  - Bmr have high digestibility, lower lignin

Why Sorghum??

Type	Brand	Plant Height (ft)	% DM at Harvest	Tons Acre^{-1} at 30% DM	# of Irrigations
Grain	HyTest 850	5.3	28.9	22.8	3
Forage	SorgoMax FS 430	8.6	26.2	28.4	3
Corn Silage	Average Values	12.5	32.0	30.0	8

Relative yields of forage and grain type sorghums and irrigation events compared to corn silage (UCCE Kings County, Carol Collar and Peter Robinson)

Bob Hutmacher's research on ET of sorghum is showing similar results

A Cropping Systems Fit for Many Places in the World

- Excellent crop for no-till conservation systems
- Excellent crop for crop rotation strategies for cotton, wheat and other annual crops
- Robust, adaptive crop for Renewable fuels production in California
- Unique food applications for grain

Questions
Look us up at: sorghum.ucanr.edu

3- Dr. Khaled Bali

Introduction to Irrigation Scheduling and Irrigation Management

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kmbali@ucdavis.edu
559-646-6541

MNS University of Agriculture
Multan, Pakistan March 26, 2019

UC CE | University of California Agriculture and Natural Resources | Cooperative Extension

Irrigation Water Management

Irrigation: The application of controlled amount of water to plants at needed interval

- Applying the right amount of water to meet crop water requirements (mm/irrigation, cubic meter/per tree per day, etc)
- Timing of irrigation events (frequency, days between irrigations, example 3 irrigations/week, etc)
- Applying the water uniformly (efficiency)

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Management Practices to Cope with Limited Water Supplies in California and other regions:

- Improve irrigation efficiency (pressurized systems or higher efficiencies in existing systems)
- Regulated deficit irrigation (alfalfa and other crops)
- New cropping systems (lower water use crops or changing practices)
- Other practices (land fallowing for water transfer, etc)
- **Irrigation management (irrigation scheduling and technologies that can save water)**

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Irrigation Scheduling

- Simple approach (Water budgeting using ETo and crop coefficients)
- Soil moisture measurement (requires extra work, soil sampling, soil moisture sensors, dataloggers, etc)
- Plant-based approach (temperature, sap flow, plant water potential, etc)
- A combination of the above three methods
- **Advances in irrigation technology and methods to estimate ETc** (Warning: Too Much Information)

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How Much Water do I need to Apply?

- Need to know crop water use (ETc) since last irrigation
- ETc from (Reference evapotranspiration and crop coefficient)
- Typical application rates (vary widely depending on soil type):
- Surface: ~ 75-100 mm/irrigation (much higher rate for light soils)
- Sprinkler: ~ 10-30 mm/irrigation
- Drip: ~ 10 mm/irrigation

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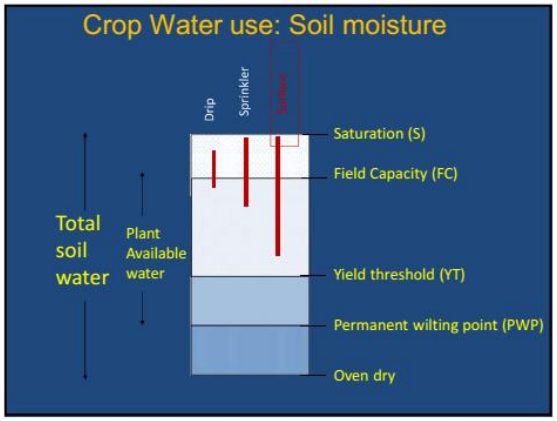
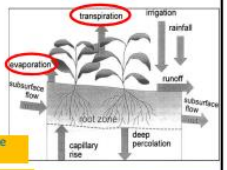
Crop Water use: Soil moisture



Why do we irrigae:
replenish the amount of water used by the crop (ET_C) since the last irrigation

Crop ET = Reference ET x Crop Coefficient

$$ET_C = ET_O \times k_C$$



Also used in system Design: Max Irrigation depth to be applied (D_{GMAX})

$$D_{G\ MAX} = \left[\frac{ETc_{(D)PEAK}}{Eff_{APP}}\right] = inches/irrigation$$

System	Eff_{APP}
Gravity	70-85%
Drip	85-90%
Micro-sprinkler	80-90%
Sprinkler	70-90%

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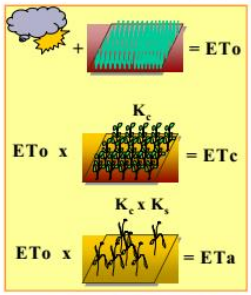
ETc and ETa



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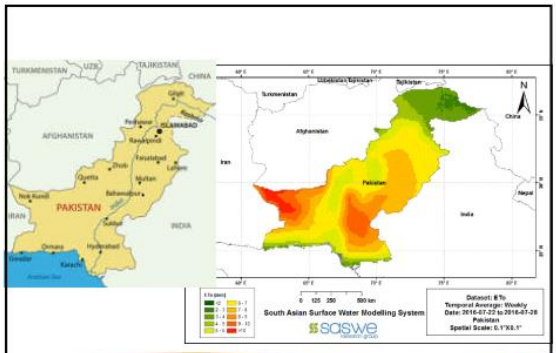
CIMIS (Map)

- Simple table to estimate ETo based on historical data
- Data based on historical average ET
- Good estimates but doesn't account for climate variability
- Not location specific (zones)

CIMIS (website)
http://wwwcimis.water.ca.gov/

- Easy to access, provide historical and recent data.
- More accurate estimate from CIMIS stations close to the farm data



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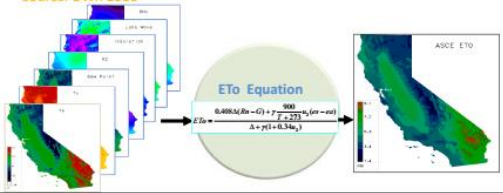
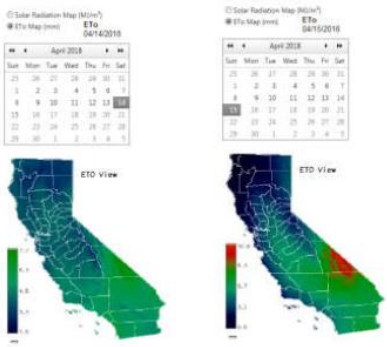
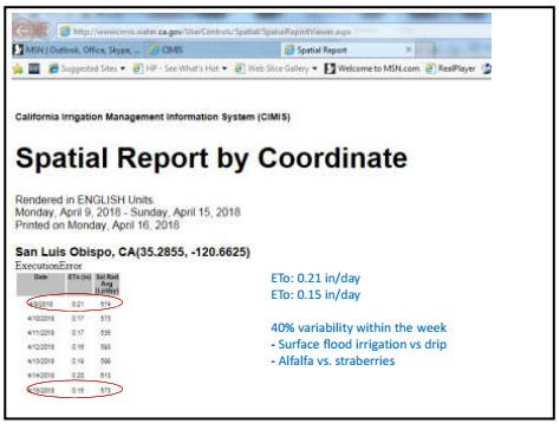
ETo: Spatial CIMIS

- Couples remotely sensed data from GOES satellite with point measurements from CIMIS stations to estimate ETo.
- Provides daily maps of ETo at 2-km grid.
- Released to the public in September 2009.

Source: DWR 2016







ET_o - accounts for weather

Solar radiation, humidity, temperature, wind

K_c - accounts for crop

- light absorption
- canopy roughness
- physiology
- age
- **surface wetness** (irrigation system)

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Crop Coefficient

$$K_c = \frac{ET_c}{ET_o}$$

ET_c - measured ET_o - estimated

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Theoretical Mean K_c Values

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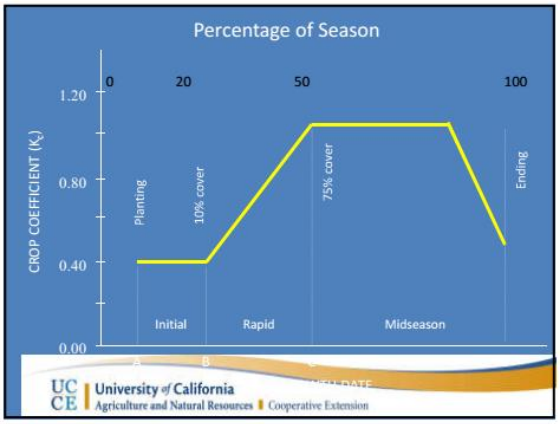

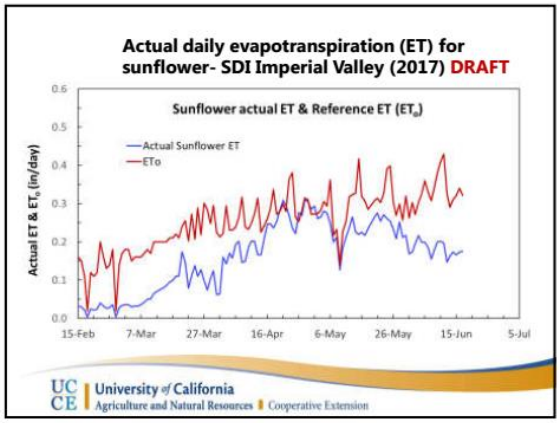

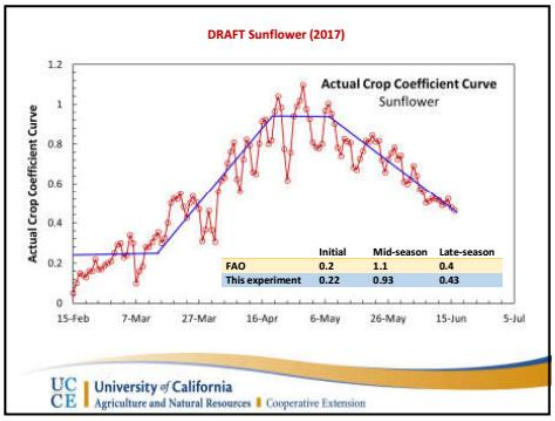
DRAFT Sunflower (2017)
Actual Crop Coefficient Curve
Sunflower
Actual Crop Coefficient Curve
1.2
1
0.8
0.6
0.4
0.2
0
15-Feb
7-Mar
27-Mar
16-Apr
6-May
26-May
15-Jun
5-Jul
Initial
Mid-season
Late-season
FAO
0.2
1.1
0.4
This experiment
0.22
0.93
0.43
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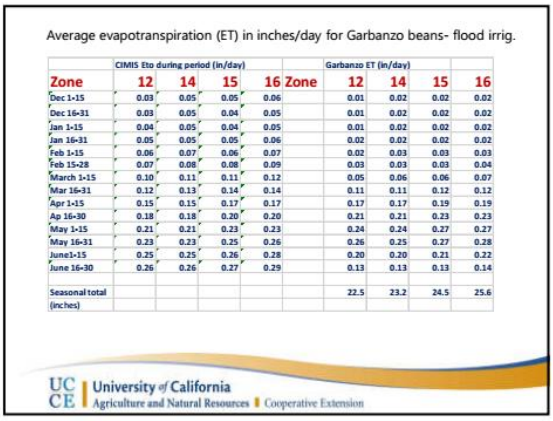
Average evapotranspiration (ET) in inches/day for Garbanzo beans- flood irrig.
CIMIS Eto during period (in/day)
Garbanzo ET (in/day)
Zone 12 14 15 16 Zone 12 14 15 16
Dec 1-15 0.03 0.05 0.05 0.06 0.01 0.02 0.02 0.02
Dec 16-31 0.03 0.05 0.04 0.05 0.01 0.02 0.02 0.02
Jan 1-15 0.04 0.05 0.04 0.05 0.01 0.02 0.02 0.02
Jan 16-31 0.05 0.05 0.05 0.06 0.02 0.02 0.02 0.02
Feb 1-15 0.06 0.07 0.06 0.07 0.02 0.03 0.03 0.03
Feb 15-28 0.07 0.08 0.08 0.09 0.03 0.03 0.03 0.04
March 1-15 0.10 0.11 0.11 0.12 0.05 0.06 0.06 0.07
Mar 16-31 0.12 0.13 0.14 0.14 0.11 0.11 0.12 0.12
Apr 1-15 0.15 0.15 0.17 0.17 0.17 0.17 0.19 0.19
Ap 16-30 0.18 0.18 0.20 0.20 0.21 0.21 0.23 0.23
May 1-15 0.21 0.21 0.23 0.23 0.24 0.24 0.27 0.27
May 16-31 0.23 0.23 0.25 0.26 0.26 0.25 0.27 0.28
June1-15 0.25 0.25 0.26 0.28 0.20 0.20 0.21 0.22
June 16-30 0.26 0.26 0.27 0.29 0.13 0.13 0.13 0.14
Seasonal total (inches) 22.5 23.2 24.5 25.6
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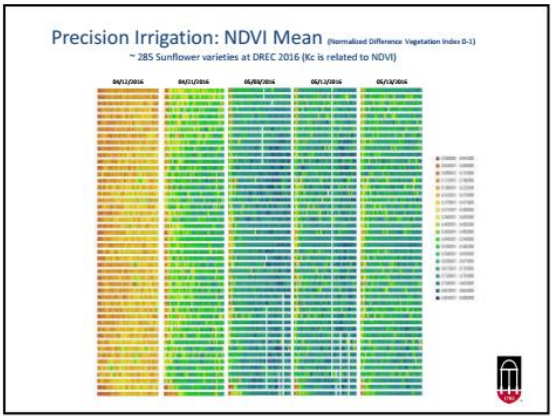
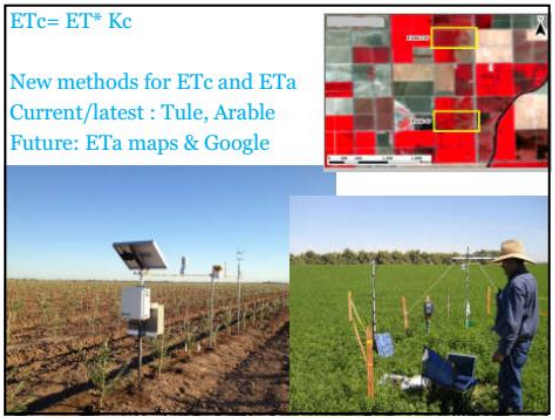
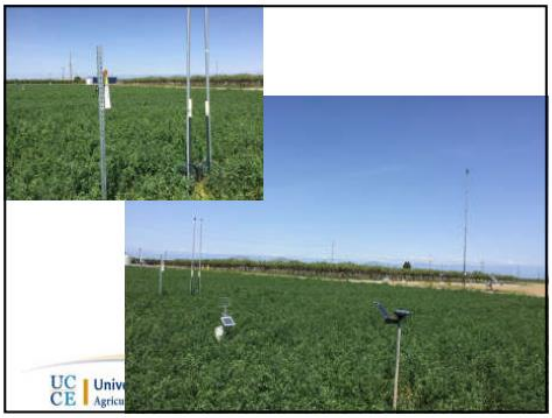
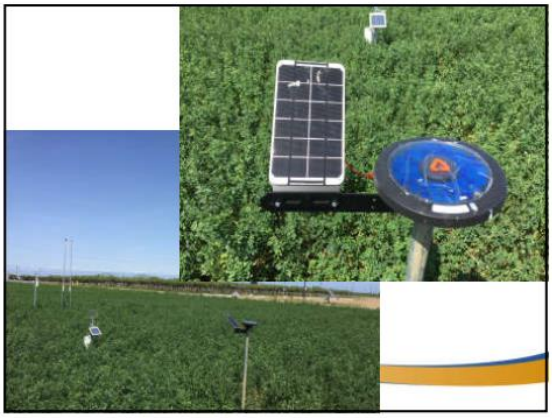
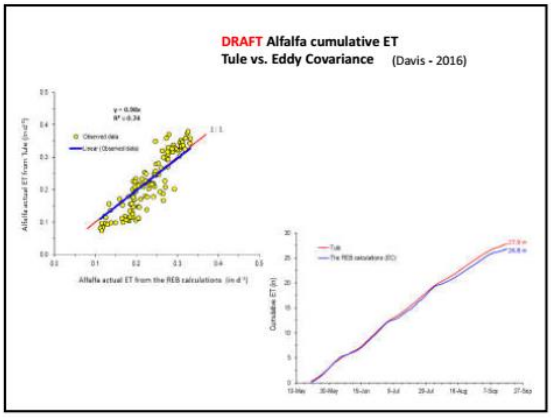
Table 1 Recommended irrigation crop coefficients (Kc) for avocado production in the South-West and northern Perth in Western Australia based on month and growth stage
Approximate growth stage
Crop coefficient South-West
Crop coefficient northern Perth
Fruit Growth 0.4 (Jul) 0.5 (Jun)
Fruit Growth 0.4 (Aug) 0.5 (Jul)
Flower development 0.7 (Sep) 0.7 (Aug)
Flowering, vegetative flush 0.8 (Oct) 0.9 (Sep)
Flowering, vegetative flush 0.8 (Nov) 0.9 (Oct)
Initial fruit drop, vegetative flush 0.7 (Dec) 0.8 (Nov)
Vegetative flush, root flush 0.7 (Jan) 0.8 (Dec)
Vegetative flush, root flush, summer fruit drop 0.8 (Feb) 1.0 (Jan)
Root flush, fruit growth 0.8 (Mar) 1.0 (Feb)
Root flush, fruit growth 0.7 (Apr) 0.9 (Mar)
Root flush, fruit growth 0.4 (May) 0.9 (Apr)
Root flush, fruit growth 0.4 (Jun) 0.7 (May)
Table 1. source: Growing avocados – annual water requirements


Precision Irrigation: NDVI Mean (Normalized Difference Vegetation Index 0-1)
~ 285 Sunflower varieties at DREC 2016 (Kc is related to NDVI)
04/12/2016
04/21/2016
05/02/2016
05/12/2016
05/13/2016


ETc= ET* Kc
New methods for ETc and ETa
Current/latest : Tule, Arable
Future: ETa maps & Google







Example: Crop Water Use:

ETc = ETo x Kc

If ETo was 0.6 inches since my last irrigation (7 days ago) and my average Kc over that period was 0.5 then:
ETc = 0.6*0.5=0.3 inches

So I need to apply a NET of 0.3 inches of water to replace the crop water use of last week

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Crop Water Use:

- Water requirements
  = ETc / AE

-AE= Application Efficiency or Distribution uniformity (70-90% for Surface-Sprinkler-Drip Irrigation), if AE is 80% then

Water requirements= 0.3"/0.80
= 0.38 inches of gross application

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Irrigation Runtime (micro-sprinkler):

=Gross amount of application (in)/Application rate (in/hr)

If the average application rate is 0.10 in/hr

Then Irrigation time = 0.38/0.10= 3.8 hrs

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Soil moisture sensors
(Example: rootzone 4')
Most of water/nutrient uptake from the top 50% of the rootzone

Typical root distribution
40% of roots in first quarter
30% in 2nd quarter
20% in 3rd quarter
10% in 4th quarter

Example (soil and crop specific):
33 cb at 12" (good moisture level)
38 cb, at 24" (good)
46 cb at 36" (getting dry)
79 cb at 48" (dry potential stress???)

Summary

ETo: Weather factors (CIMIS)
Kc: Crop factors, irrigation system, wetting frequency
Kc: in most cases between 0.3 and 1.2
Need to update Kc for major crops in California/Pakistan
Kc: depends on irrigation frequency and irrigation system
New methods for estimating crop ET (Tule- based on surface renewal)

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Thank You

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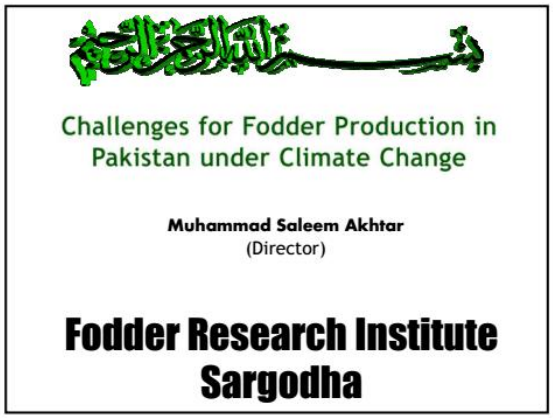
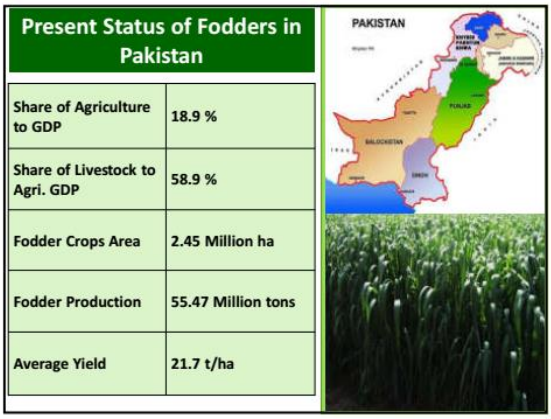
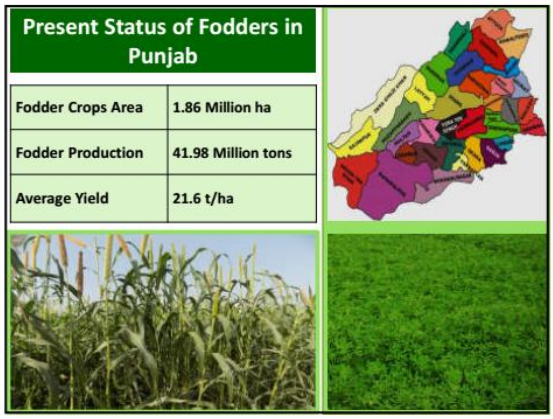
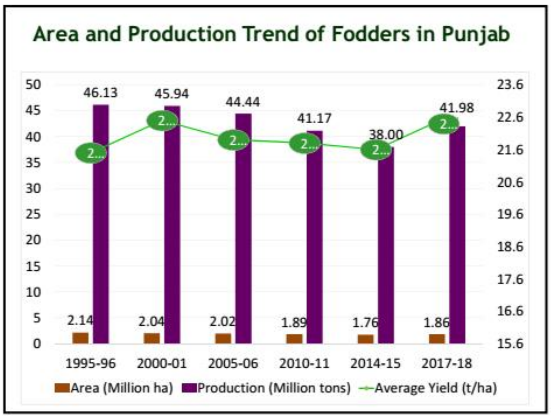
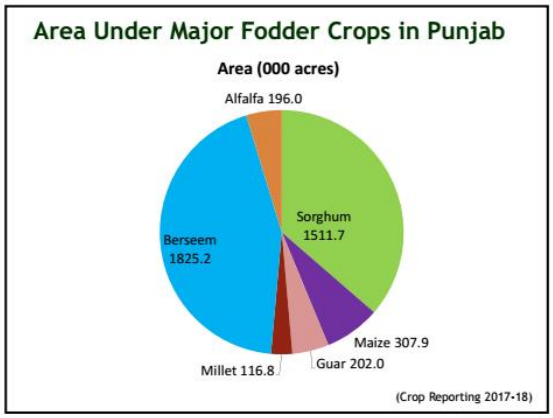
4- Mr. M. Saleem Akhtar

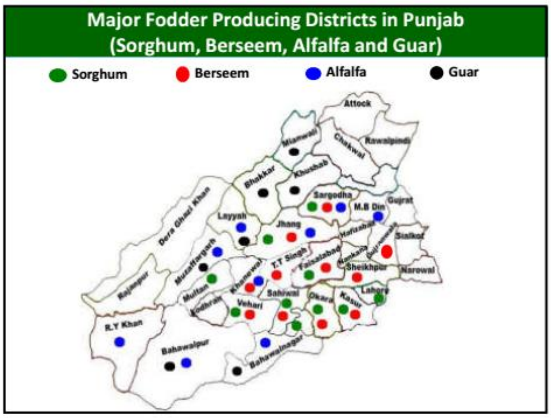








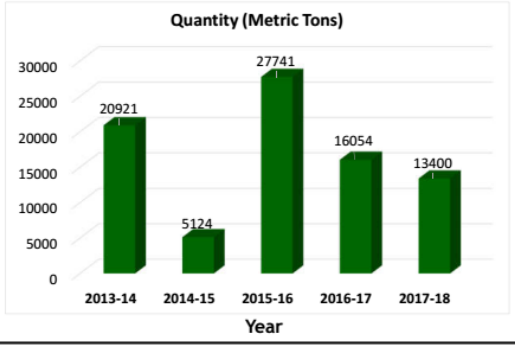




Fodder Crop Seed Requirement (Punjab)

Crop	Area Cultivated (000 acres)	Seed Requirement (tons)
Berseem	1825.2	14000
Alfalfa	196.0	1200
Sorghum	1511.7	48000
Maize	307.9	12000
Guar	202.0	5000

Total Fodder Seed Import in Pakistan
(Last Five Years)



Expected seed production under the ADP project "Improvement in breeding and seed production system of fodder crops"

Crop	Pre-basic seed production (kg's)	Basic seed production (kg's)	Certified seed production (kg's)
Berseem	3100	77500	1937500
Alfalfa	1600	32000	640000
Oats	30100	1204000	48160000
Maize	19000	2216666	258611110
Sorghum	11040	1104000	110400000
Guar	3300	198000	11880000
Total	**68140**	**4832166**	**431628610**

Livestock Population in Pakistan

Animals	No's (million)
Cattle	46.1
Buffalo	38.8
Sheep	30.5
Goat	74.1
Camels	1.1
Horses	0.4
Asses	5.3
Mules	0.2
Total	196.5

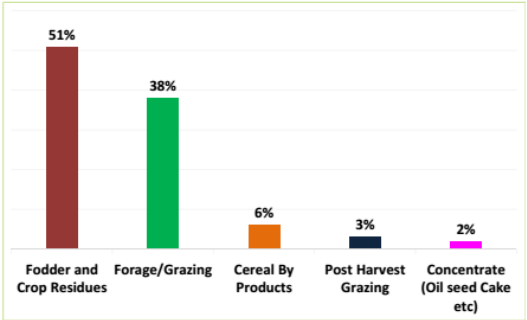
(Economic Survey of Pakistan 2017-18)

Milk and Meat Production in Pakistan

Items	Production (000 tons)
Total Milk (Cattle, Buffalo, Sheep, Goat & Camel)	57890
Beef Meat	2155
Mutton Meat	717

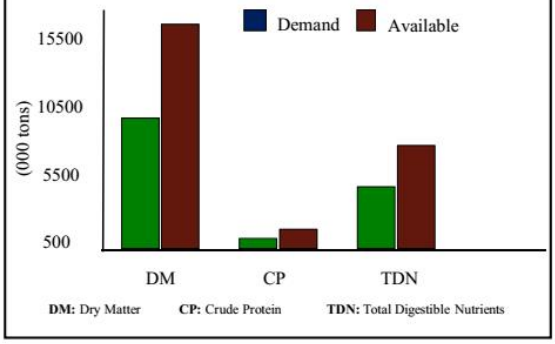
(Economic Survey of Pakistan 2017-18)

Contribution of Different Feed Resources for Dairy Animals in Pakistan



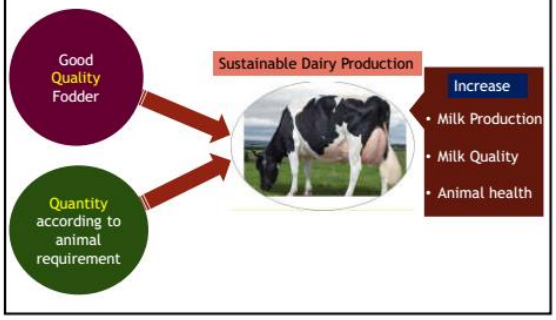
(Source: FAO Report)

Feed Availability and Demand in Pakistan



DM: Dry Matter **CP:** Crude Protein **TDN:** Total Digestible Nutrients

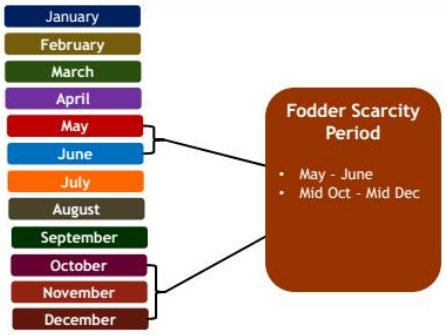
Quality Fodder is the Driving Wheel for Dairy Production



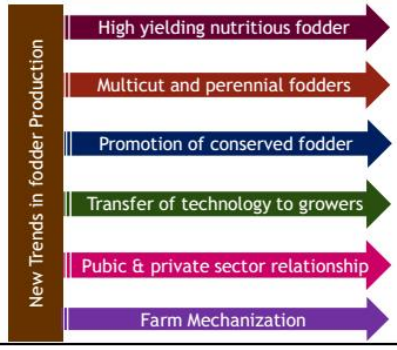
Major Constraints in Fodder Production

- Preference of farmers to cultivate cash crops like wheat and rice as compared to fodder crops
- Cultivation of low yielding unapproved fodder varieties.
- Less-Availability of good quality and healthy seed
- Allocation of marginal land to the fodder crops
- Unawareness of improved fodder production technology
- Biotic stresses (diseases, insect pests and weeds)
- A-biotic Stresses (drought, salinity, water logging and heat)
- Price fluctuations in market

Fodder Scarcity Period in Pakistan



FUTURE PROSPECTS



Major Fodder Crops in Pakistan

KHARIF FODDERS		
1.	SORGHUM	*(Sorghum bicolor L.)*
2.	P. Millet	*(Pennisetum americanum)*
3.	MAIZE	*(Zea mays)*
4.	S.S Hybrid	*(Sorghum X Sudangrass)*
6.	COWPEAS	*(Vigna unguiculata)*
7.	GUAR	*(Cyamopsis tetragonoloba)*
8.	MOTT GRASS	(Napier purpureum)
RABI FODDERS		
9.	BERSEEM	*(Trifolium alexandrinum)*
10	LUCERNE	*(Medicago sativa)*
11	OATS	*(Avena sativa)*

Approved Varieties of Fodder Crops

Winter Fodder Varieties					
Sr. No.	**Crops**	**Varieties**	**Fodder Yield Potential (t/ha)**	**Year of Approval**	**Institute**
1.	Oats	Avon	65	1983	FRI
2.		PD2-LV65	75	1983	FRI
3.		SGD-81	70	1983	FRI
4.		S-2000	80	2000	FRI
5.		Sgd. Oats-2011	87	2011	FRI
6.		NARC Oats	70	-	NARC
7.	Berseem	Agaiti	110	1986	FRI
8.		Pachaiti	110	1986	FRI
9.		Anmol	120	2009	FRI
10.		Superlate F/Abad	115	2011	FRI
11		Lyallpur late	120	2017	FRI
12	Lucerne	Sgd.Lucerne	130	2002	FRI
13	Rye Grass	RG-1	60	2011	FRI
Summer Fodder Varieties					
14	Sorghum	JS-263	50	1968	FRI
15		Hegari	55	1975	FRI
16		JS-2002	60	2002	FRI
17		Sorghum-2011	70	2011	FRI
18		Chakwal Sorghum	45	2008	BARI
19	S.S. Hybrid	Pak-Sudax	125	-	FRI
20		NARC Shahtaj	140	-	NARC
21		NARC S.S. Hybrid	144	-	NARC
22	Pearl millet	M.B-87	60	1990	FRI
23		Sgd. Bajra-2011	65	2011	FRI
24	Maize	Sgd-2002	70	2002	FRI
25	Guar	BR-90	30	1990	FRI
26		BR-99	35	2000	FRI
27		BR-2017	35	2017	FRI
28	Cowpea	Rawan-2003	40	2003	FRI

Climate Change Trend in Pakistan

Change in Temperature:

- ✓ Average annual temperature in Pakistan increased by 0.6 °C since early 1900s.
- ✓ Temperature increased in northern Pakistan is higher than southern Pakistan (0.8 °C versus 0.5 °C)

Change in Precipitation:

- ✓ Fluctuation in rainfall patterns.
- ✓ 10-15% rainfall decrease in coastal belt and arid Plains.
- ✓ Increase in summer and winter precipitation over the last 40 years in northern Pakistan.

Source: Report of Task Force on Climate Change, February 2010

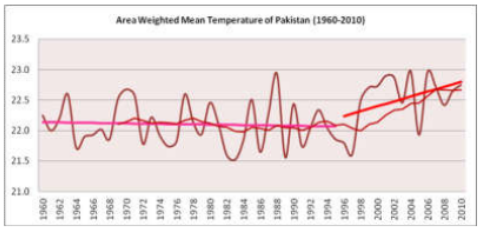
Climate Change Trend in Punjab

- The data of the mean annual temperature for Punjab during the period 1960-2015 was found as:

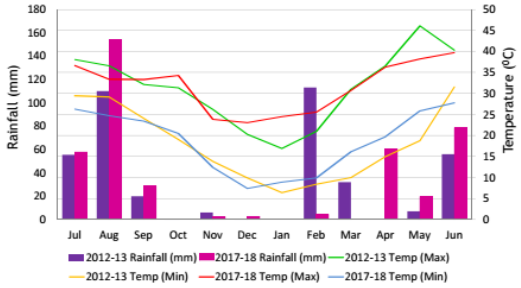
1901-1960	0.06 °C increased per decade
1960-2015	0.25 °C increased per decade

- The rate of increase is higher than the rate of increase observed globally.

Annual Temperature Variation



Temperature and Rainfall Variation at Sargodha (Punjab) during 2012-13 & 2017-18



Climate Change Vulnerabilities in Pakistan for Fodder Crops

- Increasing temperatures
- Changes in average rainfall
- Increased variability of Monsoon in timing and intensity
- Changes in availability of irrigation water
- Extreme events, such as floods, droughts, heat waves, cold waves, cyclones etc.

Impact of Climate Change on Fodder Crops

- Effect on fodder and seed yield (It may increase or decrease due to unexpected fluctuation in weather).
  - ✓ Shortening of growing season length. Due to increase in temperature, plants undergo accelerated maturity without reaching the appropriate size or height which may result in decrease of fodder and seed yield.
  - ✓ More vegetative growth due to unexpected heavy rains may increase forage yield but may decrease seed yield due to late flowering.
  - ✓ Heat stress/ drought at sensitive growth stages, e.g. flowering initiation and grain formation may hamper seed yield.

- Severe weeds problem.
- Insects and diseases attack.
- Effect on nutritional quality, palatability and digestibility.
- Rise in evapotranspiration rates leading to increased crop requirements of water.

Insect and Disease Attack

- Infestation of pests and diseases due to favourable condition of environment may influence both yield and quality of forages.
  - ✓ Diseases reduce yield, quality and digestibility
  - ✓ Insects can reduce yield more than quality.
- Under warmer and Humid conditions fungal and bacterial pathogens are also likely to increase in severity and plants would be more prone to diseases

(Reported by Beresford and Fullerton, 1989)

Climate Change Effect on Berseem

Effect:

- Extreme weather fluctuations like intense frost caused frost injury.
- Prolong cool and wet days triggered root rot and stem rot disease.
- Unexpected rains and abrupt low temperature in May, June hampered the seed crop.

Mitigation:

- Cultivation of frost tolerant varieties like Berseem Agaiti.
- Take early fodder cut to avoid prevalence of root rot and stem rot. Also practice crop rotation.
- Adjustment of last fodder cutting dates in seed crop to tackle unexpected rains effect in May and June.

Root rot in Berseem Fodder Crop

Severe root rot disease attack was observed at Sargodha during the growing period (Mid Jan to Mid March) in the current year 2019 as compared to 2018 due to more favourable weather conditions.

Climate Change Effect on Alfalfa

Effect:

- Unexpected and continuous Pre-monsoon rains adversely affected seed yield. Seed crop damaged due to re-sprouting and spoiling of seed.
- Abrupt low temperature after 15 march results in late maturity of seed crop.
- Heavy infestation of alfalfa weevil and lygus bug to fluctuating weather conditions.

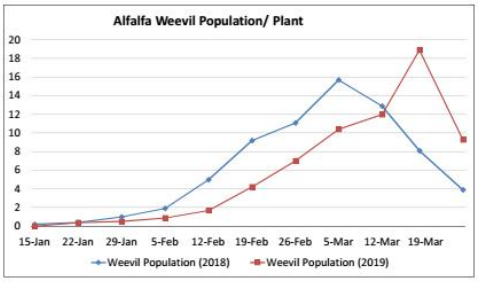
Mitigation:

- Adjust the sowing and last fodder cutting date according to weather forecast. (31st March - 15th April is suitable time for last cutting)
- Crop rotation.

Alfalfa Weevil attack on Alfalfa Fodder Crop

Severe alfalfa weevil attack was observed at Sargodha due to favourable weather condition during the current year.

Alfalfa weevil Population Trend in Alfalfa



Data were recorded on alfalfa variety "Sgd.Lucern" at Fodder Research Institute, Sargodha.

Climate Change Effect on Oats

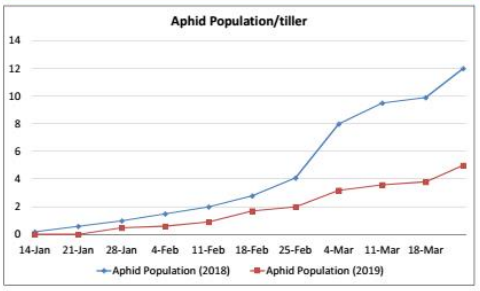
Effect:

- Severe rust infestation, due to changes in temperature, adversely decreased the fodder quality and yield.
- Variability in aphid population infestation due to abrupt changes in temperature.
- Lodging at 50% flowering due to thunderstorm adversely affected both fodder and seed crops.

Mitigation:

- Cultivate rust resistant varieties (like Sgd.Oats.2011)
- Crop rotation.
- Bed sowing to save water and to reduce lodging.
- Sowing at proper time.

Aphid Population Trend in Oats



Data were recorded on oats variety "Sgd.oats.2011" at Fodder Research Institute, Sargodha. Aphid population decreased during current year as compared to previous.

Lodging of Oats Fodder Crop

The oats fodder crop lodged due to thunder storm

Climate Change Effect on Maize

Effect:

- Abrupt rise in temperature may adversely effect the economic yield of spring season planted maize crop.
  - ✓ Loss in seed yield due to poor seed setting.
  - ✓ Loss in fodder yield.
  - ✓ Reduced quality in silage crop.
- Lodging/Stem breaking due to thunderstorm

Mitigation:

- Heat and drought tolerant varieties (MMRI Yellow & pearl).
- Ridge/ bed sowing.

High Temperature Effect on Maize

Temperature + drought stress

Tassel Blast

High Temperature Effect on Maize

Poor Seed Setting

Climate Change Effect on Sorghum

Effect:

- Unexpected cool temperature in October and November prolonged seed maturity.
- Increased temperature/ drought at early growth stage may results in more HCN.
- Severe insect and disease attack due to high humidity.

Mitigation:

- Cultivation of early maturing varieties having better fodder and seed yield (like Hegari).
- Selection of low HCN varieties (like Sorghum.2011) for fodder purpose.
- Cultivation of Insect and disease tolerant varieties (Sorghum.2011).
- Crop rotation

Climate Change Effect on Guar

Effect:

- Unexpected and continuous rains adversely affected germination and plant population of the crop as this crop is very sensitive to water logging.
- Prolonged moist conditions promoted the attack of insect pests (whitefly, jassid and aphid) and diseases (bacterial blight and alternaria).
- Heavy rains during growth period resulted in more vegetative growth and delayed flowering and fruiting.

Mitigation:

- Ridge/bed sowing to avoid damage due to stagnant rain water.
- Cultivation of disease resistant and insect tolerant varieties.
- Crop rotation

Future Strategies for Long Term Mitigation Of Climate Changes

- Promotion and selection of climate resilient fodder varieties.
- Awareness to farmers about mitigation of climate change effects on fodder crops.
- Development of high nutritious fodder varieties with better palatability and digestibility.
- Development of fodder crop varieties tolerant to drought, salinity, water logging and heat
- Development of fast growing short duration varieties with good fodder and seed yield.
- Development of fodder crop varieties tolerant to diseases and insects pests.

- Development of high yielding multi-cut and perennial fodder varieties to cope fodder scarcity period.
- Evaluation of different grasses, shrubs and trees for fodder purpose under climate change scenario.
- Germplasm diversity for different fodder crops to climate change effect.
- Awareness to farmers about crop rotation.
- Refinement in production technology to mitigate climate change.
- Development of frost tolerant fodder varieties especially in Berseem.
- Development and promotion of fodder crop varieties suitable for hay and silage.