Australian Government
Australian Centre for International Agricultural Research

Annual report

project	**Forage options for smallholder livestock in water-scarce environments of Afghanistan**
project number	AH/2012/021
period of report	July 2016 – June 2017
prepared by	Shinan Kassam (ICARDA) Serkan Ates (Oregon State University)
co-authors/ contributors/ collaborators	Mounir Louhaichi (ICARDA) Aziz Niane (ICARDA) Sawsan Hassan (ICARDA) Hayatullah Esmati (ICARDA) Abdulhaq Farhang (ICARDA) Hayley Norman (CSIRO) Bradley Nutt (Murdoch University)

1 Progress summary

Given the historical persistence of winter feeding gaps, one key objective of this project is to develop economically sustainable forage production systems within the water constrained provinces of Baghlan and Nangarhar; and through an innovation systems approach, to identify avenues for broad uptake of research-for-development (R4D) processes that support efficacy in the attainment of outputs and outcomes within the provinces of engagement as well as nationally. This necessarily involves:

- evaluating the adaptability of promising genotypes and accessions;
- demonstrating the validity and potential of these to farmers that are interested in cultivating forage and thereby reducing seasonal gaps in access to feed resources;
- identifying avenues to support an enabling (social, economic, policy) environment for gender equitable access to knowledge and resources

Within the first half of this four-year project initiative, 105 genotypes (67 legumes, 17 cereals, 21 shrubs) have been evaluated for adaptation and productivity (measured by biomass and grain yield). From these, 10 promising genotypes are being tested on-station and on-farm in order to generate data to support varietal registration/introduction. Forage shrubs are currently exempt from formal release and introduction protocols. As such, 21 forage shrub accessions/ecotypes (15 from ICARDA, 6 from Australia) have been multiplied on-station for distribution to public agencies, international and national developmental agencies as well as private farmers. Based on interest expressed by national research system counterparts, 140 cladodes of ICARDA cactus accessions have recently been planted on-station in Nangarhar in order to evaluate adaptability and farmer interest.

As the project entered its second half in July 2016, a concerted effort was made in transitioning the research and developmental initiatives towards greater ownership and oversight of national systems of research, international developmental agencies and national civil society organizations. A project working committee comprised of ICARDA and representatives from five departments/institutes from the Ministry of Agriculture, Irrigation and Livestock (MAIL) has been constituted and is functional. The committee is charged with joint planning, implementation and monitoring of project activities. Equally important is the participation of the seed certification directorate within the project working committee to ensure that the process of varietal registration/introduction of the 10 genotypes being tested is followed in accordance with existing regulations. Where ambiguity exists, there is now potential to effectively obtain clarity on process as well as to suggest recommendations for revision to, or promulgation of, new codes and regulations. Representation of international developmental organizations within the committee has been equally constructive, leading to the distribution of seed to Aga Khan Foundation for collaborative on-station and on-farm research trials within three provinces (Takhar, Badakshan, Bamyan) that are outside of the current engagement in Baghlan and Nangarhar provinces. A similar upcoming engagement with Action Aid promises to further expand the number of provinces within which collaborative engagements between ICARDA, the national research system, international development organizations and civil society organizations are enacted, tested and refined in order to ensure long term tenability.

Security concerns and instability continue to limit the range of research and development activities, as well as the intensity with which activities are being undertaken. To this end, mirror trial sites in Western Australia and Turkey provide safe environments to develop benchmark indicators for productivity and adaptability of tested genotypes in Afghanistan. Equally important has been the ability for the mirror trial site in Turkey to host national Afghan researchers and farmers for training and orientation sessions. In Western

Australia, the mirror trial site in Perth has trained two Afghan nationals on important aspects related to seed production, plant evaluation, forage agronomy and basic nutritive assessment. Supporting processes for acquisition of knowledge, as well as dissemination of this knowledge to the wider research and developmental community is ongoing, within an environment where opportunities for professional development and skills enhancement are not widely accessible. An upcoming training for six Afghan females in Perth will develop necessary skills for forage shrub maintenance, nursery management and basic forage agronomy techniques. This is closely linked to the objective within the final stages of the initiative to uncover and foster (gender) equitable and inclusive avenues and approaches for broad uptake of tested forage varieties nationally (upon official release/introduction).

In thinking ahead, the legacy of this project will be defined by the manner in which national systems of innovation have fully understood the need for treating forage crops differently from existing cereal crops – specifically within the framework of national regulations for varietal release/introduction. It will also be defined by the current interactions between international and national system research staff that have impressed on the need for addressing issues of efficacy in research, appropriate planning, effective budgeting; and equally important, the need for stronger linkages with civil society organizations for out scaling of research outputs towards the attainment of desired research and development outcomes. Based on positive experiences through sustained engagement and interaction, the project has made good progress within an environment plagued with limited national capacity (budgetary and other) as well as significant instability.

2 Achievement against activities and outputs/milestones

Objective 1: Assess the main climatic, edaphic and agronomic constraints leading to nutritional gaps and identify appropriate technologies (new species, varieties and/or management practices) to overcome or reduce constraints

No.	Activity	Outputs/ Milestones	Completion Date	Comments
1.1	Review existing literature on forage and livestock production; summarize feeding systems in each province.	Completed within the last reporting period.	Completed	The literature review and report on characterization are being revisited in order to harvest knowledge and communication related outputs (peer reviewed publications and material to support policy briefs).

1.2	Field observation of current endemic forage/range species and nodulation (legumes)	Locally available forage legumes were obtained from the market and farmer fields, tested for production potential, and compared to imported forage crops for a number of indicators.	Nodulation survey completed in June 2017 (Data analysis and report preparation in progress)	New forage crops introduced were included within a varietal comparison trial over the 2015-2016 and 2016-2017 growing seasons. In addition, root nodulation of the legumes as an indication of N fixation potentials was also monitored. Extra material (seed, inoculants etc.) as well as technical backstopping to support the study were provided by Murdoch University as part of the collaborative agreement under this initiative. The nodulation study was carried out by one of the national Afghan trainees who visited Australia in 2016 for an extended six week training course implemented by CSIRO and Murdoch University partners.
1.3	Survey aimed at better understanding existing feed sources, and constraints to access and opportunities for enhancing access.	A baseline survey was administered in order to characterize the current status of crop-livestock production systems within Baghlan and Nanagarhar provinces.	Completed in June 2015	Information from this survey is now being tapped into for the recently initiated engagement on gender within forage production systems in Afghanistan; and linked more closely to mapping out forage value chains in the provinces of direct engagement (Baghlan, Nangarhar)

1.4	Identify sites with potential to collaborate with other programs that are addressing livestock production constraints.	Collaboration with CLAP and Dairy Goat Projects funded by IFAD has been initiated. In addition, field days and training courses in collaboration with NGOs (specifically Action Aid) were discussed, planned and undertaken. 3.5 kg of forage seed has been provided to Action Aid for onward distribution to farmers within the research site 13 Action Aid staff in Mazar (2 females, 11 male) and 15 staff in Bamyan (2 females, 13 male) were trained on Atriplex plantation and seed production 200 kg of forage seed (8 varieties) has been provided to Aga Khan Foundation for collaborative on-station trials with ARIA in three provinces outside of the current two that the project currently engages with 56 kg of forage seed was requested and provided to ARIA for planting within research stations nationally (awaiting feedback from ARIA on which stations/provinces these trials are being undertaken) 1200 Atriplex saplings were dispatched to the ACIAR funded watershed initiative in Mazar-e-Sharif for planting within the research site, these were obtained from the Dhadadi farm in Mazar to which Atriplex seeds had been provided earlier by the project in order to support access to shrubs in Mazar-e-Shariff	Ongoing	This initiative has provided technical backstopping to CLAP in relation to forage species planted in Parwan and Kabul provinces; evaluation of 24 legume species received from Australia in 2015 and planted within Qargh research station (Kabul). Integration with the ACIAR-supported watershed initiative is progressing through joint sharing of lessons learned in relation to the adaptability forage shrub species which are suitable for environments targeted under the watershed initiative (Mazar and Qarasay). In 2017, a joint research initiative between the ACIAR funded forage and watershed initiatives aims to evaluate various shrub propagation techniques including direct seeding, cuttings, and transplantation of seedlings on shrub performance under semi-circle water conservation technique (link to interim report provided in Appendix 1)

1.5	Monitoring and Evaluation (Yrs 3-4)**.**	An M&E framework was developed by R. Telleria and S. Ates soon after the inception workshop in March 2014	Framework completed June 2014	Specialized training in M&E, with specific attention to ACIAR reporting requirements was undertaken in late 2016, through the engagement of a Kabul based ACIAR consultant, and in collaboration with other ACIAR initiatives currently being implemented in Afghanistan. A system for monitoring the dissemination of 200 kg of seed delivered to Aga Khan Foundation (AKF), outputs and outcomes achieved from demonstrations is being developed in a collaborative engagement between ICARDA, AKF and ARIA. Finalization of a guide has been delayed due to a shift in management personnel within AKF as well as delays in response from national research system counterparts. A draft of the guide (guidelines) is expected by the end of August 2017.

Objective 2: Evaluate forage and fodder production options for smallholder livestock systems

No.	Activity	Outputs/ Milestones	Completion date	Comments
2.1	Assemble germplasm and initial screening of potential legume species at mirror trial sites (Perth and Turkey). Mirror sites selected to match climatic/ edaphic/ systems constraints in-country (aridity, frost and opportunistic cropping in summer) (Yrs 1-3).	Currently, 2 experiments in Australia and 1 experiment in Turkey are being carried out at mirror trial sites. Four forage and forage-based sheep feeding experiments were completed at the mirror trial sites on BDIARI station (Konya, Turkey). One paper from these studies was submitted to J. of Animal Science. Another paper on the bio-economic efficiency of dual-purpose management of cereal crops is being prepared. Two more papers are planned to be submitted before the end of project.	May 2016	Assembly of germplasm and initial screening has been completed and reported in the 2015 annual report. A mirror trial site was additionally selected in Kellerberrin (W. Australia) and a grazing experiment was established in May 2016. The preliminary results are presented in Appendix 2. A similar grazing trial is being undertaken at the mirror trial site in Konya. An alley cropping experiment has been established at the Australian mirror trial site in order to test the interaction between forage shrubs and annual legumes under grazing conditions. Link to a report on activities and outputs at the mirror trial site in Perth is provided in Appendix 1.

2.2	On station screening of the most promising forage legumes, shrubs and dual purpose crops.	Evaluation of 105 annual and perennial forage crops and shrubs obtained from ICARDA, Australia, the USA, Canada and Turkey was undertaken within ARIA research stations in both target provinces. Three winter cereals-forage legume mixtures and sowing rate experiments established in Mazari-Sharif, in Sheshambagh (Nangarhar) and Poza-i-Eshan (Baghlan) Research Stations were completed. The first year results are presented within the updated technical report (link provided in the Appendix), while the second year data is currently being processed. One trial on the effect of fertilizer rates on berseem cereal mixtures in Nangarhar was completed in June 2017. Annual legumes of Australian origin, included within the 105 genotypes evaluated, were established in nursery rows for their agronomic evaluation and for seed multiplication.	Finalized in June 2017	In addition, seeds (56 kg) of promising forage crops were provided to ARIA, as requested. There is a growing interest of ARIA in developing their forage research program and continuing the activities initiated by the ACIAR Forage Project. Consideration is being given to the potential for hosting a workshop in late October or November of 2017 with key ARIA research staff in order to assist them with the articulation of a forage research programme (activities and budget) that can be implemented post-2018.
2.3	Test promising forage options in on-farm observational plots to evaluate commercial potential and to aid in adoption at scale. Data supports the case for national variety release (Yrs 2-4).	Second year of the on farm trials (four in each of the two target provinces, a total of 8 trials) were established in collaboration with 16 farmers in each target province (32 farmers in total). The second year of the experiments were finalized in June 2017.	Finalized in June 2017	In order to demonstrate effective (contemporary) practices in forage and forage seed production, a set of observational on-farm plots were undertaken in Nangarhar and Baghlan between 2015 and 2017. A short survey aimed at understanding perceptions of these farmers in relation to the varieties sown; and whether there is interest to replant was undertaken. A summary of the farmers' responses is provided within the updated technical report (link provided in Appendix 1). Preliminary indication is that there is much interest in the varieties demonstrated; though it is still unclear as to whether the interest in replanting is related to incentives provided (seed and fertilizer) or on the basis of beneficial characteristics and outcomes related to the variety provided, compared to local varieties.

2.4	Establish seedlings of perennials for demonstration of shrubs and trees with the utilization of technologies for water harvesting (in collaboration with other project in Afghanistan).	Shrub seeds of ICARDA (13 species) and Australia (5 species) origin were planted for seedling production in June 2015 in Poze-i-Eshan (Baghlan), Sheeshambagh (Nangarhar) and University of Kabul research stations. In addition to the ongoing activity on seed or vegetative multiplication from mother shrub species, a new experiment on the assessment of different propagation techniques for rehabilitation of degraded rangelands at watershed scale was established in 2017. A further activity on evaluation of cactus pear (*Opuntia ficus-indica*) in Afghanistan was also initiated in 2017.	Ongoing	An agreement between ICARDA, ARIA and Aga Khan Foundation (AKF) to support the demonstration forage crops was agreed to in principle in a set of meetings of the project working committee held in Amman and Cairo (April 29 to May 6). Final signature of AKF is in process, which was delayed due to a change in leadership within the Afghanistan office of AKF. Integration with the ACIAR-supported watershed initiative is progressing through joint sharing of lessons learned in relation to the adaptability of forage shrub species that are suitable for environments targeted under the watershed initiative (Qarasay village in Baghlan). Seeds of 4 Atriplex varieties were sent to the research trial site in Mazar for joint activities with the ACIAR Watershed Project. Twenty accessions of *Opuntia ficus-indica* were sent to Afghanistan to be planted as a mother plants for future cladodes multiplication in frost-free regions of Afghanistan. The cladodes were planted in farm e-Hada in Nangarhar on April 27th, 2017.

Objective 3: Expand the scope of existing community-based seed enterprises to include feed and forage seeds, vegetative propagation of shrubs and planting materials

No.	Activity	Outputs/ Milestones	Completion date	Comments
3.1	Forage seed system analyses	VBSE and PSE forage seed/planting materials system and markets for the forage products were included in the baseline survey	February 2015	An amendment to the MoA between ICARDA and MAIL for the forage initiative has been executed, with formal approval for the Director of the Seed Certification Directorate to be represented on the project working committee (copy of the amendment provided through a link in Appendix 1). Together with this amendment, a collaborative research agreement between ICARDA and the Royal Tropical Institute (KIT) was developed. The joint research collaboration will seek to map out the forage seed value chain, gendered aspects therein, as well as a more detailed understanding of the role of gender within forage systems in Afghanistan (Copy of the agreement provided through a link in Appendix 1).
3.2	Establish mother shrub/tree species at research station for seed or vegetative multiplication	Shrub seeds of ICARDA (15 species) and Australia (6 species) origin were planted for seedling production. The seedlings were then transplanted at research stations in Baghlan and Nangarhar regions.	June 2015	Seedlings were transplanted in 2015 at Sheshambagh (Nangarhar); plantig was delayed to April 2016 at Poza-i-Eshan (Baghlan) Research Station due to security concerns. Of the shrub species sent to Afghanistan, 5 have survived - four Atriplex: (1) *A. nummularia*, 2) *A. canescens*, 3) *A. halimus* and 4) *A. lentiformis*; and5) , *Brasica prostrata*; the fifth showing significant potential. The latter is native to Central Asia and should do well under contextual conditions within Afghanistan. In Baghlan two Australian species (*A.nummularia* # 48 and #13) recorded the highest survival rate of 42 and 38 %. respectively. A total of 140 cactus cladodes of various accessions were dispatched to Afghanistan (7 cladodes each from 20 accessions) in late April 2017. The cactus pads were planted at Hadda farm in Nangarhar in collaboration with MAIL and ARIA. Discussions between ICARDA and ARIA, related to long term maintenance of the plantation, as well as avenues for equitable access to farmers, are ongoing.
3.3	Assemble and multiply seed and planting materials of adapted forage varieties (Yrs 2-4).	Seeds of ten promising annual and perennial forage crops were multiplied at Baghlan and Nangarhar research stations.	June 2015	1,151 kg of foundation seeds were produced in 2016 at Dare-e-Noor and Farm-e-Jadeed Districts of Nangarhar for further multiplication.

3.4	Establish a breeder seed multiplication system in Baghlan and Nangarhar agricultural research centres	This activity was initiated in 2015.	Ongoing	Adaptation trials have been initiated in 2015, 2016 and 2017 in order to collect three years of data for presentation to the national seed committee for varietal registration and/or introduction. The project expects the third year data to be ready for analysis in late 2017, together with supporting evidence on farmer perceptions (through experimentation and demonstration) and nutritional analyses. The data has been generated in cooperation with the forage crop variety development of ARIA. However, the national variety evaluation and registration system within the national agricultural research for development continuum is at its establishment stage and not fully functional, particularly for forages. The registration process will, therefore, likely be prolonged beyond the project's life span.
3.5	Initiate forage seed production and distribution with existing VBSEs, PSEs and other potential suppliers within target sites	This activity was initiated in 2015.	Ongoing	Source seed production of 10 genotypes selected through crop adaptation trials were established in Dare-e-Noor and Farm-e-Jadeed Districts of Nangarhar as well as in Baghlan. The aim of the activity is to secure foundation seed for further multiplication by VBSEs and PSEs. Production figures for 2017 are being amassed and will be reported in the final report, as well as in the project's technical report. The process of distributing seed to VBSEs has been delayed until formal release of some or all of the promising genotypes. Some seed has been used for large scale demonstrations to create public awareness and effective demand for forage seed to speed-up the technology dissemination when the varieties are formally released.

Objective 4: Develop capacity of Afghan researchers in forage and livestock systems research

No.	Activity	Outputs/ Milestones	Completion date	Comments
4.1	Capacity building in monitoring and assessment of forage production and nodulation surveys	A five-day practical and theoretical training course on forage biomass and seed production, alley cropping and water harvesting techniques, and the design and management of basic forage experiments was undertaken for NARS staff on 28 April - 3 May 2017 in Amman, Jordan and Cairo, Egypt.	May 2017	A total of 15 NARS staff were trained by senior scientists from ICARDA (Agenda, images and blog posts provided through links in Appendix 1).

4.2	Capacity building in seed production and seed business management	This training was provided during the five-day training in Amman and Cairo as mentioned above. In addition, one in country training on seed processing took place in Nangarhar.	May 2017	Training on the seed production and seed business management was provided by ICARDA's seed system specialist Aziz Niane. A further training course was organized in Nangarhar during which a mechanic Mr. Ibrahim was assigned the task of assembling, testing and demonstration of the Kimseed machines purchased through project funds. The task has been performed successfully as reported. ICARDA continues to struggle with finding valid and reasonable options for bequeathing the Kimseed machine at the end of the project given a lack of observable commitment from the national research system to maintain and effectively utilize the equipment. Options are being considered for how civil society organizations may effectively use the equipment through measures for ensuring equity in access and acquisition of funds to support maintenance. A plan for training Afghan women farmers in seed propagation, nursery management and enterprise development is being conceptualized and targeted for undertaking in Australia (tentatively first week of October 2017). Letters of invitation are being drafted by CSIRO to support visa applications.
4.3	Capacity building in socioeconomic survey techniques and survey data analysis	Workshop planned for Dubai in July 2017 (completed and to be detailed within the next reporting period as it falls outside of the reporting period for this submission)	Ongoing	Through the collaborative engagement with Royal Tropical Institute (KIT), national researchers and ICARDA staff are being introduced to training on concepts related to gender as well as intra-household survey design and implementation.
4.4	Capacity building for 2 national researchers on scientific methodology, seed production, rhizobiology, plant evaluation and basic nutritive assessment.	2 ICARDA staff (Abdul Haq Farhang and Himat Sahil) were trained in Australia on forage agronomy, animal nutrition and nodulation surveys in the fall of 2016.	Completed	On return to Afghanistan, one trainee has initiated and completed a nodulation survey for legumes, while the other trainee is applying his new knowledge within the ACIAR funded watershed initiative.

4.5	Capacity enhancement for next users (development partners and farmers)	One field day was organized for 79 farmers, extension officers, agriculture students and ICARDA staff at the ongoing trial sites in Nangarhar on 27 March 2016. 6 females (private farmers, international organization staff, ICARDA staff) will be trained in Australia on shrub propagation and nursery management practices in October 2017. On return to Afghanistan, it is anticipated that Aga Khan Foundation will provide an enabling environment for the female farmers to utilize their skills within the framework of small and medium enterprise (SME) development, with technical backstopping from ICARDA as required and feasible	March 2016	Farmers attending the field day expressed interest in a number of recommended forage crops (berseem, sainfoin) as well as rapeseed and alfalfa; and in testing cereal-legumes mixtures The proposed trainees to Australia are currently engaged in filling out weekly diaries, developed in collaboration with the Royal Tropical Institute, and which are an inherent part of the gender research framework (link to the draft framework provided in appendix 1)

3 Project Outcomes and Impacts

Objective Verifiable Indicators	Achievement (Annual and Cumulative)
Number, type and productivity benefits of new forage and fodder options promoted. • At least three new forage cereal/legume and two shrub species promoted. • Expected increase in forage production of 25% through the promotion of high yielding forage species with an extended season of forage availability. • 1000 new households growing promoted forage species will decrease the lamb mortality rate by 15-20%; increase weaning weight by 3 kg per lamb; and increase ewe prolificacy by 15% in the short term • Feed costs are reduced by 10-15% • Overall benefits from increases in forage and animal production result in 10% higher incomes.	A total of 102 improved annual and perennial forage legumes and cereal genotypes of various origins, together with 18 shrub species have been evaluated for their dry matter and nutritive value content in Baghlan and Nangarhar provinces (irrigated environments) and Mazar-i Sharif (rainfed environment). Based on agronomic performance, farmer's perception, and perspectives on ease of seed production, ten annual and perennial forage crops (alfalfa, narbon vetch, common vetch, Hungarian vetch, grass pea, sainfoin, triticale, oats, rye and Lathyrus) were identified to have potential (economic and environmental) value within regional contemporary crop-livestock production systems; and more generally within the republic as a whole. Seeds of these have been multiplied and are being demonstrated on-farm in order to promote familiarity and interest prior to official introduction/release. The objectively verifiable indicators listed to the left, and as defined in the initial project document, are now questionable in light of a better understanding of regulatory systems. It appears that there was an early presumption that forage crops would not enter into the formal system for seed production and commercialization. There is still ambiguity in this regard. Farmers engaged with on-farm demonstrations have the right to retain forage produced with the varieties tested and demonstrated for use as forage, but not the right to sell or use the seed in the subsequent cropping seasons for forage crop production without prior approval. This, given that the varieties under trial have not officially passed through the seed committee for wide spread release. As such, farmer to farmer dissemination, as well as introduction into local and national seed value chains has not taken place. By late 2017, farmers will have limited access to the promising genotypes through the

Objective Verifiable Indicators	Achievement (Annual and Cumulative)
	large scale verification and demonstration trials that the project hopes will be jointly undertaken by Aga Khan foundation (possibly Action Aid in addition) and ARIA. At best, the on-farm demonstrations are raising awareness on the potential of new varieties and possibly (hopefully) demand for the seeds in anticipation of release for broad uptake.
Number and percentage of farmers (men and women) incorporating new forage and fodder options on their landholdings: • A total of 1000 farmers (80% male – 20% female) to be engaged in the new forage production options.	As an initial step a total of 24 farmers in Baghlan and 24 farmers in Nangarhar have been engaged in the maintenance of on farm observation plots in order to provide farmers on adjacent lands with visual proof of higher productivity and economic value. Through field days, on farm demonstrations and linkages with other ongoing projects this initiative is further attempting to reach out to crop-livestock farmers, and farmer unions in Nangarhar province. The “Dairy Union”, representing approximately 1500 farmers is one specific example of expressed (consolidated) need for improved forage seeds and tested agronomic packages as expressed by farmer members. As forage production in the country is much lower than demand, there is a presumption that any variety/ technology introduced by the ACIAR-Forage project will be quickly adopted by farmers, either individually, or through institutions such as the Dairy Unions who are “customers in waiting” for the outputs. Similarly, the recently completed MAIL-IFAD-ICARDA dairy goat project has established a network of 1200 women who are eager to continue their engagement with research for development initiatives through the adoption of effective contemporary production practices (soft knowledge) and technologies (embodied knowledge) generated through this initiative. While there is expressed interest from both of these farmer networks, effective engagement and linkages is limited to the extent of seed availability, which is expected to be available for greater distribution in early 2018. More importantly, however, are regulatory requirements that restrict the widespread dissemination of seed prior to formal release/introduction.
Area planted and productivity benefits achieved by farmers incorporating new forage and fodder options: • Area planted with new forages at research and demonstration sites is expected to total 10 ha in each Province. 200 ha of land at the provincial level to be dedicated to new forage production options.	12 hectares of land in Nangarhar are currently being utilized as on-farm demonstration plots, but in Baghlan the size is much smaller (0.1 ha) due to security concerns. In terms of forage trials on research station, 0.25 ha in Baghlan and 0.80 ha in Nangarhar are under project oversight. Attainment of desired land under demonstration and research trials continues to be limited due to lack of seed availability. The lack of availability in seed is due to: (i) time required to generate seed; (ii) delays on the part of the national varietal release committee; and (iii) delays in securing greater amounts of land within research stations for research trials and multiplication given what appears to be political sensitivity in this area and (protocol and institutional) delays in the engaging of formal discussions with the Ministry of Agriculture.
Accessibility of new forage and fodder options for farmers: • Seeds and planting material available through 2 Village-Based Seed Enterprises (VBSEs), and 4 community-managed plantations.	Quality seed and seedlings of the (10) tested, well-adapted and small holder livestock preferred forage and pasture species and cultivars selected through the project have been planted in Dare-e-Noor and Farm-e-Jadeed Districts of Nangarhar; and in Baghlan to produce, process and make available for further multiplication and dissemination. There has unfortunately not been any movement on seed commercialization due to stringent regulations related to formal variety release that are complex, lengthy and fraught with

Objective Verifiable Indicators	Achievement (Annual and Cumulative)
	difficulties in an environment with both limited national capacity and budgetary resources.
Number of village and informal seed programs incorporating new forage and fodder options, and quantity available: • 2 of 17 well-established Village Based Seed Enterprises, will be used for forage seed processing and delivery. In addition, 4 community-based forage shrub plantations will be established, to provide shrub seed and seedlings to farmers.	Specialized threshing and aspiration machines for forage crops have been purchased from Kimseed in order to upgrade the quality of seed produced from adapted and small livestock holders' preferred forages and pastures for further multiplication and use. A training course on forage seed production and post-harvest seed operations was completed in the fall of 2016. While genotypes have been evaluated, and source seed produced, large scale seed multiplication and commercialization by VBSEs and PSEs is constrained by limited national capacity to operate the complex variety evaluation and release processes stipulated within the national seed laws and regulations. Project scientists from ICARDA and Australia continue to work with national counterparts on navigating through the complexities as well as in the imparting of experiences internationally; with a desire that regulations related to forage varieties within national regulations for release will be relaxed over time.
Improved capacity and policy commitment of Afghan agencies in the ownership and operation of testing programs for new forage and fodder varieties: • Provision of technical backstopping and in service training to enhance the capacity within Afghan research institutions and agricultural service providers.	A total of five in and out of country training courses have been organized on the forage and forage seed production as well as the design and management of basic agronomy trials since the inception of the project. In April 2016, a training course was realized in Turkey for Afghan NARS. Another training course for NARS partners was undertaken in Amman and Cairo on 27 April-3 May 2017. Extended training in Australia for two young field staff on forage agronomy and animal nutrition was also realized in the fall of 2016. Training of Afghan females (6) in shrub propagation techniques, nursery management and enterprise development is being scheduled for the last quarter of 2017 in Australia. Technical training in the set up and operation of the Kimseed seed cleaning equipment was provided in late 2016 for staff from MAIL, as part of the training workshop held in Nangarhar; and in two technical visits of national project and MAIL staff to ICARDA seed facilities in Lebanon as well as collaborating institutions in Perth (Murdoch University, CSIRO). A list of participants to the training is provided within the latest version of the technical report, a link for which is provided within the appendix.

3.1 Research Outcomes

Research trials, within which the effects of seeding rates and planting of forage legumes and cereals in mixtures relative to forage monocultures were tested, have improved both practical and theoretical knowledge and understanding of national research staff. Through engagement with ICARDA, CSIRO and Murdoch University scientists, national researchers have sharpened their practical skills in relation to: (i) evaluation of seedling survival rates – germination, field establishment and limiting factors (seed dormancy and temperature) in annual and perennial forages; (ii) avenues for addressing issues related to effective on-farm forage and fodder crop and seed production.

Research trials have generated significant interest from the development community, with Aga Khan Foundation now collaboratively involved in overseeing on-station research and demonstration trials in provinces outside of the project area; and Action Aid expressing interest in following suit.

3.2 Scientific impacts

An early assessment of improved forage varieties with varied physiological and functional attributes has demonstrated their production potential and suitability for crop-livestock farming systems of Afghanistan. Research trials on sainfoin, alfalfa and berseem clover are providing knowledge on options for how to better utilize scarce inputs such as water and fertilizer effectively in forage production - an area which has not received due research attention in Afghanistan – neither historically nor contemporarily.

Ultimately, increased productivity within forage-based crop-livestock farming systems is expected to increase incomes as well as security and asset wealth in healthy livestock holdings. To what extent this is achievable in the long term remains unclear in light of ongoing conflict and an inability to run research trials within Afghanistan under desired research conditions. To this end, mirror trials being undertaken in Western Australia and in Konya/Turkey provide insight into agronomic and animal production potential of forages being introduced into Afghanistan, under 'best' production and management practices, and within stable security environments. Mirror trials provide benchmark indicators which are helpful in uncovering avenues and approaches for bridging the gap between experiential outputs (in field and on-station in Afghanistan) and those obtained under ideal conditions.

Testimonial from a MAIL partner (online link provided in Appendix 1) provides insight into a number of areas where NARS partners exposed to international research sites (Jordan and Egypt) see value for ongoing research (new and improved) being undertaken in Afghanistan.

Through greater interaction within the project working committee, and within the process of handing over data and project information to the national system of research, the national institute for agricultural research (ARIA) has recently taken on a more prominent role in the assignment of field staff for maintenance of on-station trials. While issues continue to remain in terms of budgets to support basic maintenance, there is clear indication of growing ownership of research trial sites. This is a positive development in view of maintenance of on-station trials and demonstration sites after the end of the project.

3.3 Capacity impacts

In-service training activities for both NARS and national ICARDA research staff have provided improved knowledge and understanding on dryland forage and forage seed production systems and how to better design and manage basic forage experiments with greater efficacy. They have also helped in a better understanding of the scientific process and created opportunities for establishing multidisciplinary work with NARS and NGO collaborators. Whether or not national budgets will continue to support the research undertaken within the current life of this project, as well as after completion of the project, remains an open question.

In realizing that a significant number of international organizations are active in Afghanistan, within the area of agricultural development, attention to training staff of NGOs is now well appreciated. In 2016, 13 staff of Action Aid in Mazar (2 female and 11 male) and 15 staff in Bamyan (2 female and 13 male) were trained, together with one research staff based at ICARDA offices in Mazar, on aspects related to Artriplex plantation and effective seed production practices.

Two young ICARDA staff trained by CSIRO and Murdoch University collaborators are now applying their new skills learned in Afghanistan. One has recently completed a nodulation survey for forage legumes under trial within this project, with technical backstopping from

Murdoch University (Brad Nutt). The other is applying his new skills within the ACIAR funded watershed initiative.

3.4 Community outcomes and impacts

3.4.1 Economic impacts

Given limitations to broad uptake of the forage seeds under trial, in light of regulatory restrictions for release/introduction, it is too early to gauge economic impacts that can be directly or indirectly attributed to the project's interventions.

3.4.2 Social impacts

Ongoing gender focussed research attempts to answer three overarching questions that are likely to be of immense importance for developmental outcomes as the initiative ultimately hands over process, outputs and outcomes to national systems of innovation:

1. What are the systemic constraints to closing the winter livestock feed deficit within existing value chains, and what opportunities (entry points) exist to mitigate these constraints?
2. For different typologies of households (female headed, conventional) how do the four dimensions of (i) decision making, (ii) norms and values, (iii) access, control and use of resources and (iv) division of 'labour and responsibilities' affect issues of equity and inclusivity within forage production systems?
3. What are the perceptions and realities related to the sharing and development of knowledge for women within agricultural production systems in Afghanistan, and more specifically within forage production and marketing systems?

Co-opting national research system partners and private sector participants into the development and implementation of this research has uncovered a wealth of information on bias related to the roles of women in agricultural production and marketing. Through greater interaction and joint research, one expected outcome is a better understanding of the need for sensitivity in recognizing these prejudices and in addressing the core underpinnings of bias in order to meaningfully affect change.

3.4.3 Environmental impacts

Given the short timeframe under which project activities are being undertaken, impacts may not be quantifiable within the life of the initiative. Over time, however, and if research outputs are taken up at broad scale, there is anticipation of improved soil fertility and enhanced water productivity within both rain-fed and irrigated production environments.

3.4.4 Policy impact

While data to support formal release/introduction of the forage and cereal legumes under trial has been generated in full cooperation with the national partner organization (ARIA), formal release is likely to be attained after the lifetime of this project. This matter has been discussed on a number of occasions within the annual PoG meetings. The national system continues to insist on release prior to commercialization. While there is optimism that in the future, these demands will be relaxed for forage varieties, and partly based on continuous dialogue and evidence of global experience, the best that this project can hope for within its lifetime is:

- Credible field performance and superior nutritive value data from the germplasm adaptation trials and demonstrations for possible use in variety release;

- A sizable seed stock from the promising lines for further popularization, multiplication and dissemination upon release;
- Public awareness creation for effective forage seed demand upon variety release to facilitate and speed-up the scaling out process of the forage technologies generated.
- Scientific outputs (publications) to inform both policy and the research community

With this in hand, formal release/introduction of the varieties under trial is expected in 2018.

3.5 Stakeholder engagement and Communications

One research paper titled “Feeding value of rye, triticale and wheat straw produced under a dual-purpose management system” was submitted to J. of Animal Science on 5th July, 2017.

Another paper on dual-purpose management of cereals is under preparation. The paper (titled Bio-economic analyses of winter cereals under dual-purpose management in high and low input production systems) will be submitted by the end of 2017.

In addition, two extended abstracts were presented at the 10th International Rangeland Conference, Saskatoon, Canada on 16-22 July 2016:

- Constraints to Forage Production and Rangeland Management in Afghanistan (Serkan Ates, David Feindel and Mounir Louhaichi).
- Livestock and Forage Production in Afghanistan (Hayatullah Esmati, Mounir Louhaichi, Abdoul Aziz Niane, Shinan Kassam, Sawsan Hassan, Abdulrahman Manan, Chandrashekhar Biradar, Yashpal Saharawat and Serkan Ates).

Technical leaflets on general forage agronomy, Atriplex, cactus and sainfoin production are currently under review and expected to be published in Dari by the end of August, for distribution to farmers.

Data related to on-station and on-farm trials have been handed over to the national institute for agricultural research (ARIA), within the ongoing transition and handover phase.

Links to technical reports, blogs, meeting and workshop agendas are presented in Appendix 1.

4 Training and capacity building activities

A five-day practical and theoretical out-country training course on forage production (biomass and seed), alley cropping and water harvesting techniques was undertaken for NARS staff on 28 April - 3 May 2017 in Amman, Jordan and Cairo, Egypt. A total of 15 trainees with various professional backgrounds (scientists, farmers, seed producers) attended the training course (Links to the event provided within Appendix 1).

In Jordan, ICARDA scientists - Mounir Louhaichi, Biju George, Sawsan Hassan and Stefan Strohmeier - provided a practical lecture on “water harvesting techniques using forage shrubs and alley cropping techniques”. In addition, Dr Louhaichi facilitated a visit to a women’s enterprise seedling multiplication (sponsored by United States Forest Service). Dr Aziz Niane (ICARDA) organized a meeting with the Jordanian national research system (NCARE) on knowledge sharing related to varietal introduction and release processes in Jordan (forage specific but also in general). In Egypt, Dr Serkan Ates (Oregon State University) and Dr Sawsan Hassan (ICARDA) provided lectures on forages in annual cropping systems and discussed the results of Afghanistan trials with the

participants. A field visit to the national forage research center in Cairo provided participants with a brief glimpse into productivity potential for berseem clover within irrigated environments. Dr Aziz (ICARDA) delivered a presentation on variety evaluation and release and implications on seed delivery, while Egyptian researchers provided an insight into the varietal introduction and release processes in Egypt. In parallel, collaborators from the Royal Tropical Institute (KIT) held a session on outlining a gender research framework with female participants and interested researchers from ICARDA and MAIL.
A training course on the design and management of basic forage experiments, cactus agronomy and production and seed cleaning and processing was given on 9-11 November 2016 as part of the annual project-planning meeting. A total of nine trainees from MAIL, DAIL, ICARDA, ARIA attended the course and the meeting. Training on seed processing and forage seed technology was done by Dr Brad Nutt (Murdoch University) and Dr Aziz (ICARDA). Specific attention was paid to understanding potential reasons for lack/low germination of forage species being tested for adaptability in Afghanistan. Of primary importance was the finding that seed scarification had not been undertaken by project staff prior to sowing which is essential for good germination and that they were now aware of the method and the importance. This oversight highlights the implications of an inability for international scientific staff (ICARDA, Australian partners) to visit the research sites within Afghanistan, and to engage more deeply with national staff on technical and scientific undertakings.

5 Intellectual property

Not applicable within this reporting period.

6 Amendments to personnel and project activities

None to report within this period.

7 Problems and opportunities

Other than the inability for international project staff to visit the research sites, all other challenges and issues are generally manageable. The striking of a project working committee and (generally) regular contact through Skype has improved both working relationships as well as efficacy in implementation of project activities on the ground.

8 Evaluative Learning

Most of the introduced forage crops show positive potential to improve productivity within crop-livestock farming systems in Afghanistan.

There is now greater appreciation on the part of national research staff (ICARDA as well as NARES) for incorporating a gender lens into research for development initiatives; yet, prevailing norms and conventional wisdom continue to colour perceptions and an effective ability to undertake research initiatives which test propositions related to equity, equality and inclusivity. Through inclusivity in research design and implementation, the project hopes to break down these barriers to equity in access to knowledge and resources.

Questions related to ownership of research outputs, outcomes and long term sustainability are a concern, particularly so given the limited national research budgets, as well as a

fragile security situation within much of the republic. While project initiatives are aimed at fostering a more enabling policy, institutional and investment environment for research and development, as well as functional linkages between the two, ownership and longevity of research initiated under this project will largely be a function of political will and political economy.

What initially was thought to be institutional issues/challenges in relation to effective collaboration and territorial sabre rattling appear to be more about (individual) personalities and potential insecurities. Through engagement with members of the project working committee, as well as within the project working committee, these barriers appear to be crumbling; and a more enabling environment for fostering effective dialogue being built in place of previous (personal) tensions.

9 Budget

With the exception of lower than expected resources due to a decline of the Australian Dollar relative to the US dollar over the current life of the project, there are no significant issues to report in relation to budgets. Full expenditure of project funds is expected by the end of the current project cycle (December 31st), with a relatively large portion of remaining funds left in the collaborator and partnership line items for Australian collaborating institutions (CSIRO, Murdoch University).

Should ACIAR wish to entertain a short no-cost extension to the project, a small quantum of funds could be allocated to support a more effective closing workshop venue, together with a budget to support staff time in the completion of a number of technical reports and publications. These activities could effectively be undertaken within the first quarter of 2018 and would lead to greater efficacy in the preparation and submission of technical reports and peer reviewed publications which would otherwise be prepared in haste, in light of the upcoming project end date of December 2017.

10 Appendix

PROJECT RELATED REPORTS

1. Technical report on ongoing on-station and on-farm trials: https://www.dropbox.com/s/6bimhia4x6r43h2/ACIAR%20Afghanistan%20forage%20initiative%20technical%20report_ver%20July%2023%2C%202017.docx?dl=0

2. Report on rangeland research activities undertaken within the project: https://www.dropbox.com/s/6rorvl3tjesbjgg/Rangeland%20activities%20interim%20report.docx?dl=0

3. Report on activities undertaken at the mirror trial site in Perth: https://www.dropbox.com/s/ytjhfznz68ri4ir/WA%20mirror%20experiment%202016.docx?dl=0

AGREEMENTS SIGNED WITHIN THE REPORTING PERIOD:

1. Amendment to the MoA between ICARDA and MAIL in relation to the composition of the project working committee: https://www.dropbox.com/s/iieiabkvoiow33h/MOA%20amendment.pdf?dl=0

2. Agreement with the Royal Tropical Institute (KIT) for collaborative gender focussed research:

https://www.dropbox.com/s/02hwq70u5e4d5cd/ACIAR%20%20Forage%20Options%20Afghanistan%20-%20MOA%20KIT%20%28signed%29.pdf?dl=0

3. Tri-partite agreement between ICARDA, ARIA and Aga Khan Foundation (awaiting execution from AKF, but agreed to in principle by all parties): https://www.dropbox.com/s/9bkvmajqztnxvkl/ICARDA-ARIA-AKF-Extension%20LoC.pdf?dl=0

TRAINING AND WORKSHOP AGENDAS, IMAGES AND ATTENDANCE LISTS

1. Agenda for 2017 activity planning meeting (Beirut): https://www.dropbox.com/s/7gaxue6tp2hjau5/Forage%20planning%20meeting%20%282017%29%20FINAL.docx?dl=0

2. Jordan and Egypt travelling workshop agenda: https://www.dropbox.com/s/a79krfpgqo974p0/Final%20Agenda%20%28Jordan%20and%20Cairo%29_Apr%2027.docx?dl=0

3. Jordan and Egypt travelling workshop participant list: https://www.dropbox.com/s/9qwnssp8m8rag2f/Final%20participant%20list%20and%20logistics.xlsx?dl=0

4. Images from Jordan and Egypt travelling workshop: https://www.dropbox.com/sh/56ujgal7todu4lk/AACUoZD3XbuFq2UCDY85s9dLa?dl=0

COMMUNICATIONS

Reflections from MAIL participant to the travelling workshop (Jordan and Egypt): http://www.icarda.org/update/reflections-afghanistan-forage-initiative-event#sthash.HtgDfL6s.5F5KXcKz.dpbs

Sneak peek: Value chains and gender workshop in Dubai (July 3rd, 2017): http://www.icarda.org/update/improving-forage-value-chains-afghanistan#sthash.5hX3NoST.RXXlhofX.dpbs

https://livestock.cgiar.org/2017/07/05/forage-options-afghanistan/

https://www.kit.nl/sed/news/ulufa-seed-feed/