

From traditional orchards to advanced fruitculture: establishing the bases of commercial horticulture in Afghanistan

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Abstract: The Afghan economy is based essentially on the primary sector and, namely, on fruit production. A cross road of trade along the "Silk route", local traditional fruitculture based on the *bagh* (home garden) is widely variegated in terms of species and varieties. Afghan fresh and dried fruits (namely raisins) and nuts, sweet and rich in flavors, are demanded by domestic and foreign consumers. The lack of traceability and quality of the propagation material has been considered one of the basic bottle necks hindering development of an advanced horticulture. During the period 2006-2015 the Perennial Horticulture Development Project (PHDP), funded by the EC-EuropeAid Program, has been supporting the Ministry of Agriculture, Irrigation and Livestock of Afghanistan through a process of collection and selection of local fruit varieties in order to improve the private nursery system, as well as perennial horticulture. About 850 accessions of different fruit tree species have been collected and entered into the National Collections at six PHD Centres, where they undergo a standardised characterisation and identification procedure in order to be formally registered in a national list, hence contributing to their safeguard and protection. The best accessions were used as source for a traced propagation system after phytosanitary indexing and also in numerous adaptive experimentations. The PHDP contributed in capacity building at technical and institutional level, fostering the establishment of nursery sector associations, providing expertise and developing the Afghanistan National Nursery Growers Organization (ANNGO) and the apex Afghanistan National Horticulture Development Organization (ANHDO), mainly concerned with value chains.

1. Introduction

Historical, cultural and institutional aspects

Afghanistan, a variegated and multiethnic country, is the result of 5000 years of continuous interaction between different cultures and civilizations, and conflicts with neighbouring powers. More recently the social, educational, and economic situation of this country has been shaped by a conflict dating back more than 30 years. The effects of war have had an overwhelming negative impact on governmental structures (e.g. Ministry of Agriculture and Universities), causing an almost complete absence of guidance and regulations for promoting agriculture, the leading sector of the Afghan economy.

Notwithstanding the destruction generated by the conflict, the rural cultural heritage and social structure has coped with these events better than urban areas where human resources were deeply hit, hence increasing the country's isolation from the international community. At present, material rehabilitation and human capacity building are still a priority in Afghanistan.

Afghan universities in particular were greatly affected by the conflicts to the point that their level of education and research is still below adequate standards. This is mainly due to a lack of financial support (even for physical re-building and the payment of salaries) and a generalized very poor human capacity (with a few outstanding exceptions). Similarly, public institutions such as the Ministry of Agriculture need international support in order to re-assume their expected role in society.

Over 75% of the Afghan people live in rural areas

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and the agriculture sector contributes about half of the GDP of the country. Afghan agriculture needs to grow at least 5% per year over the next decade (World Bank, 2014). This is a big challenge as technology, communication and transport, irrigation, and education are substantially deteriorated due to the conflicts and lack of maintenance.

Both public and private institutions lack physical infrastructure, necessary regulatory frameworks, and skilled staff to build a modern and competitive agricultural sector.

Environment

Two-thirds of total surface of the country (652230 km²) is made up of mountainous terrain and dry plains with little or no vegetation. Only 12% of the land is ever cultivated due to high declivity and low rainfall, and out of approximately 8 million ha of cultivated land, only about 2 million can be irrigated. Although there are areas rich in high quality groundwater (from melting snow), the irrigation capacity decreases during the summer. A limited number of dams and irrigation schemes were built during the 1950s and the 1960s and efforts are currently on going to rehabilitate water resource infrastructures and extend the irrigated areas.

Water resources are the main limiting factor for agriculture in Afghanistan. Precipitation is limited, ranging between 200 and 500 mm/year between December and March in agricultural areas. Rain-fed agriculture does not exist, except in limited areas where “spring wheat” cultivation is possible.

Though arid and often a semi-desert, the Afghan landscape also forms a gigantic watershed close to the Himalayan and central Asian region, with five major river basins and tremendous underground water resources yet to be fully studied and developed.

Fruit cultivation and crops in general are possible only on irrigated land, hence the typical Afghan landscape of dry, deserted mountains and greenery on the foothills, around aquifers and canals. In the irrigated areas, there is high potential for species diversification.

The climate is harsh in central and northern Afghanistan, with very cold winters and very hot, dry and, in many areas, windy summers. Nevertheless, the most common temperate fruit species are grown from 250 m up to 2-3,000 m above sea level. Citrus and similar evergreen species can be grown in parts of eastern Afghanistan; southern areas have generally mild winters. High mountain chains divide the country into hundreds of deep, narrow valleys with

specific microclimates, each one with different typical fruit varieties, which are essentially determined by the interaction between altitude and orography. A good indicator of this is the yearly mean number of frost-free days which ranges from 137 in the Salang area (elevation of 3172 m), 188 in Gazni (2183 m) to 315 in Jalalabad (566 m) (College of Agricultural and Environmental Sciences, 2003).

The land tenure

The land tenure in Afghanistan is extremely diversified, but characterized by fragmentation and a prevalence of smallholdings and subsistence farming (see table below). Almost 30% of the irrigated land is owned by 70% of the farms with less than 5 ha. These include 11% of the land and 45% of the owners with less than 2 ha. However, farm owners of more than 10 ha own 70% of the irrigated land (Table 1) (Maletta and Favre, 2003). The generally small size of the farms is making it problematic to achieve an economy of scale. Nevertheless, as we have seen in many parts of Europe, it could be possible to mitigate this constraint by promoting producers’ associations. That is, whenever safety and the social and economic conditions make it possible as the path towards farmers’ associations is extremely difficult in the present context.

Table 1 - Distribution of irrigated land in Afghanistan

Farm size (ha)	Farms (%)	Land (%)
>50 Ha	1	15
20-49.9	5	19
10-19.9	9	18
5-9.99	14	18
2-4.99	26	19
<2 Ha	45	11

Commercial horticulture is currently taking place, prevalently in small size orchards often with mixed production, which is a handicap as the market requires high quality and standardization of productions. However, the conditions exist for even small, commercially oriented farmers to plant orchards of commercial size (i.e. 1 ha or more) with the right commercial varieties on suitable rootstocks, now provided by the Afghanistan National Nursery Growers Organization (ANNGO) certified nurseries. These factors, along with the promotion of producers’ associations could render Afghan fruit growers much stronger and competitive in the domestic and international market.

The development of horticulture in the general agricultural context of Afghanistan

For many centuries, the livelihood of the Afghan people has been associated with the cultivation of fruits and nuts and this has become an intimate part of their life, food, culture, and identity. What is today's Afghanistan developed at a cross road of the trade along the "Silk route", having a comparative climatic advantage over its neighboring countries in hot and humid South Asia and very cold Central Asia. These became - and still are today - the natural outlets for Afghan fruits and nuts.

Afghanistan's strategic position explains the broad diversification with many temperate fruit species which originated in the Middle East, and central and eastern Asia, as confirmed by old records showing a strong traditional linkage between the Afghan people and fruits (fresh and dried fruits and nuts). For instance, Qasem Ebne Yousof Abunasre Herawi, in his "Guide to agriculture" of the XIV Century, mentioned over 100 types of grapes for the area of Herat. *Bagh* is the word meaning "home garden" - an area usually protected by clay walls, forming a special micro-climate - where a wide range of species and varieties are grown (often from seed) and from which most local varieties originate. *Bagh* also mean specialized mono-specific orchards that supply most of the fruits. Scattered trees disseminated in community areas also consistently contribute to fruit production (e.g. nuts like pistachios and seldom "wild" pomegranates).

The main perennial fruit species cultivated in the country are grapes (fresh and raisin), almond, pomegranate, apricot, plum, pistachio, citrus (potential "niche"), olive (potential "niche"). The main annuals (vegetables, excluding pulses and cereals) cultivated are onions, potatoes, cumin, and melon, and other cultivated vegetables (including tomato, cauliflower, broccoli, spinach, lettuce, chilli, pepper, okra, cucumber, watermelon, etc.) (College of Agricultural and Environmental Sciences, 2003).

Afghan consumers are eager for very sweet, extremely low acidic and tasty fruits; the sunny, dry weather contributes to the necessary requirements and facilitates fruit drying and conservation. Fruits represent a valuable product both for subsistence and profit. Fruit and nut production in 2014 reached 1567000 t (Fig. 1), representing more than 16% of the entire primary production of this country, which confirms Afghanistan's vocation for fruitculture, nevertheless yields are very low if compared to those of countries with advanced fruit-growing systems (even

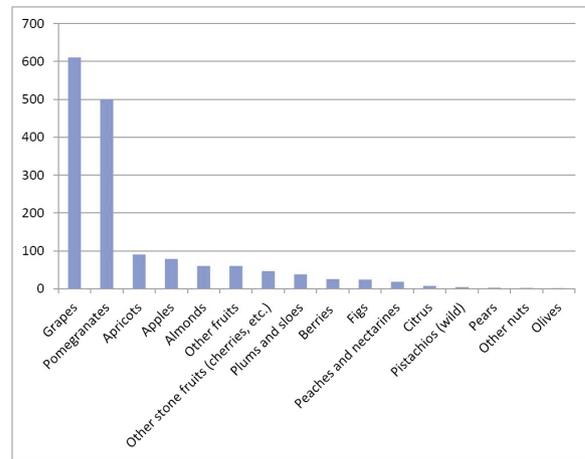


Fig. 1 - Fruit production of Afghanistan in 2014 (1,000 metric tons). FAO, 2016; other sources.

if hardly comparable because of inconsistency of statistical data). For instance, Afghan yield is about 38% of that of Italy for peaches and nectarines. These figures point to problems in terms of fertility, production systems and cultural practices. The adoption of innovative strategies to increase yield and to reduce losses during post-harvest management and marketing, two issues far from being exhaustively afforded and solved, is a must in order to face the high growth rate of the population (average of 3.2%, against 1.2% of the world in the last ten years).

In the 1970s the production of fruit and nuts was estimated as 34% of the total export of Afghanistan and agriculture as 51% of the total GDP (Guimbert, 2004), while exports were only 5.2% of the total GDP (underlining that most of the agricultural production was consumed in the country, thus the importance of the internal market).

Over the last 35 years, following the Russian invasion and internal conflicts with foreign interventions, the production and export of fruits and nuts has continued, but Afghan exports lost ground and the important segment of the international market (i.e. EU and USA) was taken by competing production from Iran and Turkey, which attained higher quality standards.

In the last ten years, efforts to revive horticulture have been ongoing with the support of various donors including the EU, WB and USAID. Between 2006 and 2015, Afghan trade regained some of the lost ground and Afghanistan became the seventh largest exporter of raisins (US\$ 150 million) and the eleventh largest exporter of almonds (US\$ 110 million) (World Bank, 2011). Fruits and nuts constitute 35% of Afghanistan's total exports. This sector still has great potential for further growth and increased

income for rural households.

Today, the estimated area invested in horticulture is 340,000 ha, representing 14% of the total irrigated land. Around 2 million people are involved in horticulture to varying degrees and the contribution to the GDP is estimated at 1.4 billion USD (34% of the agriculture GDP contribution and 6.7% of total) (Pain and Jensen, 2014; World Bank, 2014).

Brief description and observations regarding the present cropping pattern

Although Afghanistan is in the midst of a major shift towards commercial agriculture, the general cropping pattern is still wheat-based. For a long time, government and international donors have subsidized wheat seed, based on concerns for food security. The very idea of investing part of the land in fodder production is not even an option for most of the rural families, which own or manage a small farm and are mostly focused on subsistence needs. The needs for animal feed are fulfilled through grazing, crop residuals or agro-processing by products (such as cotton and flax), kitchen waste or imported industrial feed (for stall fed animals). Wheat straw is largely used as a fodder (often mixed with Urea or seed cakes) and it has a market of its own. Most of the limited areas invested in fodder crops are intercropped with fruit trees. Because of the importance of livestock in the rural economy, the demand for fodder is extremely high and its production can be an income generating activity, as we can see in various parts of the country where fodder like fresh alfalfa is sold in bundles in bazaars.

There is an important economic consideration that concerns the commercial farms. Afghanistan has entered into the global market and could import wheat from regions that produce at a lower cost and have a surplus (namely the Pakistani Punjab, one of the largest grain producing areas in the world). The economic return of an orchard in Afghanistan can be four to five times higher than one of the same area invested in wheat production. Moreover, the cost of wheat production in Afghanistan is much higher than in Punjab or other traditional wheat exporting areas. Therefore, the investment in temperate fruit production is a natural choice for commercial farms in Afghanistan, rather than trying to compete in areas where they are at a disadvantage. It is interesting to note that this is a very fortunate circumstance in which economic, climatic and environmental considerations join hands.

As cropping patterns are the result of economic

and social factors that have operated for centuries, changes are not easy. However, a shift towards commercial agriculture is in progress and in the near future we can expect that economic factors will drive the most progressive farms towards a greater investment in horticulture, with change and rationalization of the cropping pattern. Yet the process may be very slow or limited to a few farms or the private sector may adopt a short-term vision and neglect the important environmental factors.

Here lies the important role of the public sector to accelerate and incentivize the process. The Ministry of Agriculture and various donor agencies and development projects could consider introducing in development packages promotion and incentives for changes that rationalize the cropping pattern in order to fully exploit the commercial potential of Afghanistan's agriculture and at the same time mitigate, halt, and reverse ongoing soil fertility degradation.

Opportunities and constraints of Afghanistan fruitculture

The main opportunities and positive factors for development are: comparative climatic advantages in the region (dry and hot spring/summer), long tradition of horticulture and reputation of Afghan varieties, opportunity to replace growing imports in domestic market (World Bank, 2014); opportunity to increase yield and quality through adoption of suitable rootstocks and varieties, intensive cropping systems and suitable orchard management practices; high demand for quality fruit saplings; rich genetic diversity. Furthermore the development of horticulture is part of the national development strategy and supported by international donors, few private agribusinesses are starting to invest in quality control, and more farmers associations are under formation. Notwithstanding security issues, the presence of consistent international donors developing projects in the primary sector guarantees an emergent agriculture.

The main constraints of the Afghan fruit-culture can be summarized as follows: small land holdings, small commercial orchards, lack of standardized product, poor orchard management, low yield, lack of infrastructure and substandard storage, sorting, packaging, marketing, transport facilities, high cost of quality inputs, low quality standards, inadequate public services (extension, applied research, meteorological services), growing imports to fill higher standards demand in main cities, poor range of varieties

in vegetables and lack of applied research to extend marketing opportunities and marketing season, define cropping calendars, etc.

2. The Perennial Horticulture Development Project (PHDP I and II)

Origin and objectives of PHDP

During 2002-2003, the Italian Cooperation funded FAO through a grant for the restoration of the Afghan germplasm. Shortly thereafter, the FAO staff approached the European Commission for financial support and in 2004 the European Commission Delegation organised a feasibility study focused on the development of the Ministry of Agriculture, restoration of the old mother stock nursery systems, and some germplasm collection. Actually the subjects involved were: a) germplasm collection and nursery development; b) clean germplasm systems; c) provision of facilities for the development and testing of new varieties and new growing systems of horticultural crops; d) training programmes for implementing agencies; training for senior extensionists/MAIL staff/farmers/traders; linkages between MAIL and universities; and e) development of an integrated horticultural research and technology transfer system.

The objectives of the Perennial Horticulture Development Project were defined in the overall scheme of a number of horticultural development projects taking into account the Agriculture Master Plan (7), following a design aimed at emphasizing the involvement of the Ministry of Agriculture, Irrigation and Livestock (MAIL). The included objectives were the maintenance of reference collections, research and extension production methods and regulation of the industry, backed up by appropriate analytical lab-

oratories and an inspection and quarantine system, and minimizing MAIL involvement in the production of fruit trees and in the development of mother nurseries. As stated in the project web pages “The specific objective of the project is to develop a demand oriented and export led perennial horticulture industry”. A major purpose of the project was the development of the nursery sector to strengthen and to qualify fruit production, by establishing a traced nursery system based on the propagation of true-to-type local varieties.

Funding and partnerships

In 2006 the European Commission-EuropeAid Program funded, through a public/private consortium formed by IAK Agrar Consulting GmbH, AHT GmbH and the University of Florence-Italy, the Perennial Horticulture Development Project (PHDP) (www.afghanhorticulture.org) in support of MAIL. A second phase was supported by the EC for the period 2010-2015 to a wider consortium (Agriconsulting SpA, Department of Agri-food and Environmental Science - University of Florence, Department of Agricultural Sciences - University of Bologna, Centro Attività Vivaistiche, Landell Mills UK) with the contract “Technical assistance to MAIL to strengthen the planting material and horticulture industry in Afghanistan (EuropeAid/129-320/C/SER/AF/2)”.

Activities related to the germplasm collection

The framework comprised the following steps: a) individuation of superior trees in productive orchards; b) cataloguing and definition of the *in situ* National Collection; c) propagation from the *in situ* original mother plants; d) establishment of the *ex situ* National Collection; e) characterisation and evaluation; f) foundation of traced and clean mother stock nurseries (MSN) (Fig. 2). The concept underlying

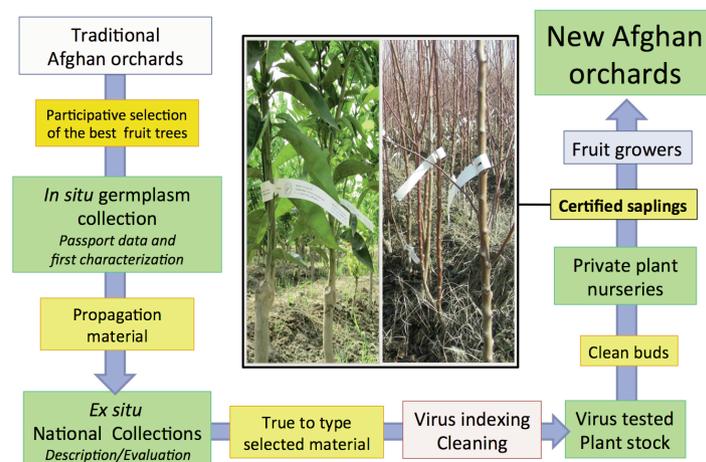


Fig. 2 - Scheme of PHDP germplasm activity: from the collection in the traditional mixed bag to the establishment of new specialized orchards. Source: PHDP.

ing all the activities can be summarized with the call for a meeting with local nurseries and fruit-growers: *It is the intention of the PHDP to undertake various initiatives that create and develop a system that ensures the availability of the best possible planting material for the perennial horticulture industry in Afghanistan, and to ensure the long term sustainability of such a system owned by the private sector.*

Support activities, capacity building and sustainability

The workplan included the establishment of six centres (the main one located at Badam Bagh - Kabul, the others in Herat, Jalalabad, Kandahar, Kunduz and Mazar-e-Sharif) and a Laboratory of Biotechnology for plant indexing and micropropagation. Long term sustainability involved essentially handing over the system built up by PHDP to the local staff of MAIL and of two organizations, the “Afghan National Horticulture Development Organization” (ANHDO) and the “Afghan National Nursery Growers Organization” (ANNGO)” (Giordani *et al.*, 2014). Apart from the described objectives, PHDP activities were related also to public and private sector institutional and regulatory reform and training and extension.

PHDP main results

A previous publication described the main goals achieved by PHDP up until 2013 (Giordani *et al.*, 2014). In the present paper, the authors summarise the achievements of the project once it was officially completed (December 31, 2015). More detailed information is available on the web (afghanhorticul-

Table 2 - Number of accessions belonging to the *ex situ* National Collection of Fruits and Nuts of Afghanistan located in the six PHDP Centers

Species	Location of PHDP Centers	Number of accessions
Almond	Mazar and Kunduz	106
Apricot	Kabul and Mazar	128
Apple	Kabul and Kunduz	81
Pear	Kabul and Kunduz	53
Sweet and Sour Cherry	Kabul and Herat	28
Japanese and European Plum, Myrobalan	Herat and Kandahar	77
Peach	Herat and Kandahar	116
Grape	Herat and Kandahar	139
Pomegranate	Kandahar and Jalalabad	79
Fig	Kandahar and Jalalabad	16
Citrus	Jalalabad	66
Date palm	Jalalabad	6
Loquat	Jalalabad and Kandahar	12
Persimmon	Jalalabad	24
Olive	Jalalabad	10
Total		935

Source: PHDP II Report - Agriconsulting.

ture.org).

The national collection of fruits and nuts of Afghanistan

After the surveys of 2006-2008 in the most important areas of fruit production when the best and most “profitable” varieties were chosen together with fruit growers (who were recognized as “custodial” of the *in situ* selected accessions), an *in situ* collection formed of over 850 accessions was defined. *Ex situ* collection orchards were established in the six PHDP Centers in plots with six to ten replicates; they constituted the National Collection (NC) (Table 2). Among fruit species, only citrus, loquat and persimmon accessions, donated by CRA-Centro di ricerca per l’agrumicoltura e le colture mediterranee - Acireale (Italy) and IVIA-Valencia (Spain) have been almost completely imported and placed in Nangarhar valley (Jalalabad Province) because of its warm climatic conditions. Some accessions of cherry, peach, plum, apple, and pear were recovered from plants derived from previously imported propagation material. On the other hand, apricot, almond, grape, and pomegranate varieties were mostly collected locally. The standardised procedures of characterisation (e.g. adoption of internationally recognized specific descriptor lists for the different species) started in 2009 and up to now around 80% of all collectable data have been inserted in a database (Table 3).

Table 3 - Status of characterisation of the accessions collected in the National Collection of Fruits and Nuts of Afghanistan

Species	Progress in description and characterization
Almond	56 varieties fully described. Register printed and distributed
Apricot	72 varieties fully described. Register printed and distribute
Pomegranate	78 varieties fully described. Register under translation
Plums	50 varieties fully described. Register in preparation
Peach	82 varieties (description almost completed)
Cherries	24 varieties fully described. Register under translation
Grape	60% of description completed
Apple	50% of description done; started description of fruits
Pear	50% of description done; started description of fruits
Citrus	Fruit description in process (only for first evaluation purposes)
Fig	in progress
Loquat	in progress
Persimmon	in progress
Date	in progress
Pistachio	Not started yet, accessions recently introduced
Olive	Not started yet, accessions recently introduced

Source: PHDP II Report - Agriconsulting.

After completion of the description and individuation of true-to-type and unique identified local varieties for each species, the accessions, as previously

done for almond and apricot (Ministry of Agriculture, Irrigation and Livestock, 2014, 2015), will be registered by the Ministry of Agriculture, Irrigation and Livestock of Afghanistan. Actually, the NC represents both a repository of local germplasm and the officially guaranteed source of material to establish the Mother Stock Nurseries (MSNs) in different parts of the country.

Capacity building

An operative Laboratory of Plant Biotechnology (LBP) has been established in Kabul through scientific, educational and technical collaboration of the Department of Agri-Food and Environmental Science of the University of Florence, the Department of Agriculture of the University of Bologna, and the company Centro Attività Vivaistiche (CAV) of Tebano (Ra) - Italy. The LBP verifies the health status of national and exotic germplasm of fruit trees, applying international standards (e.g. European Plant Protection Office protocols) and, being equipped with the facilities for plant tissue culture, it is in charge of micropropagation of the most valuable rootstocks for peach and cherry.

Another result focused on sustainability and based on local human resources was the establishment of two organizations. The first, the Afghan National Nursery Growers Association (ANNGO), represents 30 Nursery Growers Associations spread throughout the country. All the involved private nurseries (about 1000) have accepted the ANNGO regulatory system for the production of true-to-type and

traced saplings, deriving from MSNs with clean material from the NC, to be sold to fruit-growers. ANNGO also provides services related to business improvement and marketing promotion, sanitary controls, monitoring of the quality of planting material, improvement of nursery techniques and production of clonal rootstocks, certification and inspection services including labeling of certified saplings, technical training and dissemination of innovations, and publication of the catalogue. The production of certified saplings has increased from 340000 in 2012, to 1500000 in the last selling season (2015). The second organization, the Afghanistan National Horticulture Development Organization (ANHDO), is actually an NGO devoted to the development of a modern horticulture in partnership with MAIL and the private sector, and it is promoted and tutored by PHDP. Its aim is to provide continuity to PHDP main activities and to enable horticulture stakeholders to improve the industry by providing technical services, upgrading capacities, and promoting private-public coordination.

Adaptive research

Following a bottom-up procedure, adaptive research has been integrated within the PHDP framework from the very beginning (Fig. 3). There were 25 scheduled trials in 2015, most of them related to the topics considered to be at the base of improvement of fruit growing productivity and quality, such as self- and inter-compatibility in almond, plum and apricot varieties; grafting compatibility with vigour reducing

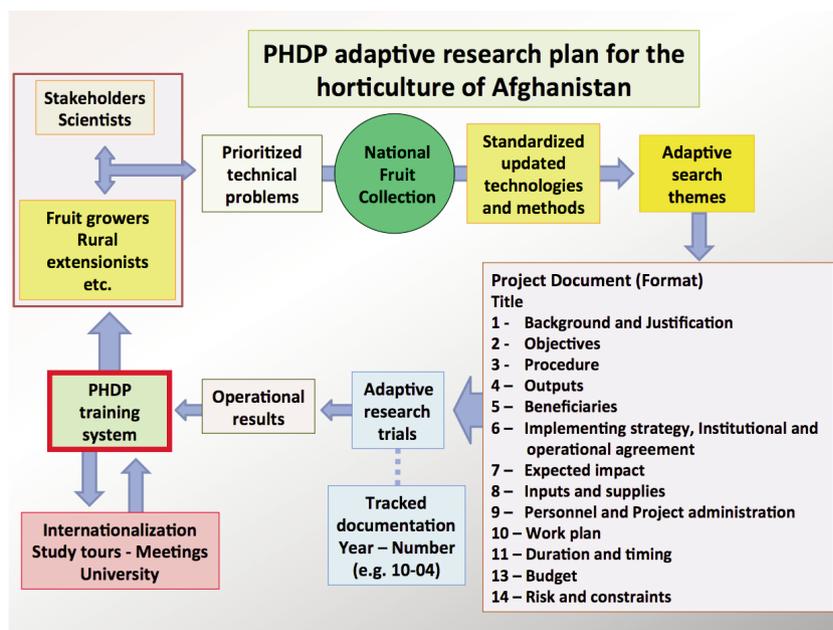


Fig. 3 - The circle of adaptive research within PHDP: from the definition of priorities to the impact of the achieved results. Source: PHD-P II Report - Agriconsulting.

rootstocks (pear, cherry); chilling requirement; potential value for breeding and breeding activities (almond and apricot); micropropagation of rootstocks; pruning (grape) and training systems (apple). A plan to develop adaptive research has also been defined for upcoming years.

3. Conclusions

The pivotal role of the perennial horticulture development project

The EU-funded PHDP (2006-2015) has set the foundation for modern and sustainable development of commercial fruitculture in Afghanistan. The PHDP constituted the National Collection of Fruit and Nuts of Afghanistan and promoted a traceability system from the National Collection to the private nurseries organized in provincial associations and represented nationally by the ANNGO. For the first time in history, the orchard growers in Afghanistan could purchase labeled fruit saplings that certified the origin of the variety and rootstock and phytosanitary control of the mother stock material. As a result, thousands of new orchards are being planted with good marketable varieties, which will result in higher yield, better quality, and more income for the fruit-growers. The PHDP also conducted focused adaptive research, identifying the pollination interactions among plum and almond varieties and started a long term breeding program for almond and apricot. At this writing, all the above services have already been handed over to the Ministry of Agriculture of Afghanistan through a process of transition supported by the EU. At the same time, in the second phase, the PHDP promoted and developed the ANHDO which has become an independent and reputed organization, acting as a catalyst in the private sector, implementing projects to improve the value chain of the main fruit productions and work on post-harvest, quality standards and marketing. By addressing the foundation of horticultural development and having the strength of a strategic vision and the patience to work consistently for nine years, the PHDP took a pivotal role in the development of fruitculture in Afghanistan. The outputs of PHDP will have a relevant impact on development of the sector and on the Afghan economy as a whole for many years to come.

Future projections

Due to a lack of proper data and statistical treatment, it is extremely difficult to quote figures and

attempt projections about future development of agriculture and horticulture in Afghanistan. However, based on the latest assessments (Altai Consulting, 2014) there has been a tremendous expansion in terms of the land invested in horticulture in the last 44 years, passing from 220000 ha in 1960 to the circa 340000 ha of today. But for the last 10 years yields had remained the same, indicating that the increase of horticultural production has been achieved almost exclusively at the expense of investing more irrigated land. Taking into account an estimated potential of 750000 ha of land invested in horticulture, a further 73% increase is expected in the next 10 years. This increased investment of land should be combined with extended irrigation schemes, and an upgrading and modernization of the extension and quality input and technical services provided to the farmers. As a result it is hoped that yields, quality standards, and marketability will also improve, thus generating income and jobs. This scenario is certainly possible, but will also require a modernization of the obsolete government institutions so that they become service oriented, providing needed policies and regulations and fostering partnerships with the private sector. This is perhaps the greatest challenge for the entire horticulture sector in Afghanistan.

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