

Scientific registration n° : 118

Symposium n° : 45

Presentation : poster

Traditional agriculture in semiarid western Iran. A case study of the Hamadan region

Agriculture traditionnelle dans l'Ouest semi-aride de l'Iran. Un cas d'étude dans la région Hamada

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INTRODUCTION

Farming based upon production factors and practices used by farmers for generations is called traditional agriculture (Schultz, 1983). Traditional agriculture is fading as the supporting rural social structures are disintegrating under the pressure of factors such as population growth, urbanization and new farming techniques. Only in remote areas, still living in relative autarchy, traditional farming can be traced. With the emerging paradigm of sustainability, study of traditional agriculture is receiving more attention assuming that much can be learnt from it (Farshad and Zinck, 1995). Hereafter, the production factors of a traditionally managed farming system are studied in the semiarid western Iran, namely the Hamadan plateau.

The Hamadan plateau (1750 m asl), located at the foot of the central Zagros mountain range (3600 m asl) about 400 km southwest of Tehran, has a semiarid steppic climate with mild summers and very cold winters. The mean annual rainfall ranges between 320 and 350 mm. Winter precipitation is mainly snow, lasting some six to eight months in the mountainous areas and one to two months on the plateau. The rest of the precipitation is provided by scarce spring and fall rains. The mean monthly temperature in Hamadan varies from -5 °C in January to 24 °C in July, with an annual mean of 11 °C. Mean extreme temperatures are -10 °C and 36 °C, respectively. Over millennia, the local people belonging to tribes of different origin (e.g. Persian, Turkish, Kurdish, Lorish) developed dry-farming and irrigation techniques to adapt to the above climatic constraints.

HISTORICAL DEVELOPMENT OF AGRICULTURE IN IRAN AND THE HAMADAN PROVINCE

According to archaeological studies in Sialk, a district of Kashan 250 km south of Tehran, and in Zagheh, near Ghazwin about 300 km north of Tehran, people moved at the beginning of the last post-glacial period (approximately 10.000 to 11.000 years BP) from drying valleys in the mountains to plains where more water was available (Ghirshman, 1938). Deep excavation in the Sialk mound brought to light relics and remains of primitive agricultural societies. The Sialk culture flourished at the beginning

of the fifth millennium BC, whereas the Zagheh mound dates from the eighth millennium BC (University of Tehran, 1971). Our own research in the Sharra valley, in the vicinity of the village of Shirin-abad about 50 km east of the city of Hamadan, shows that around 2500 years BP the land was used for rice cultivation. An old gleyed soil surface, containing small pieces of pottery, is buried under about 1.5 m glaci deposits, originated by torrential transport in semiarid conditions from the surrounding highlands.

Many dynasties with different socio-political structures have governed Persia. In some past periods, such as between 559 and 330 BC, Persia included the whole extent of the present Iran, Pakistan, Afghanistan, Turkey, Palestine, and parts of Egypt and the former Soviet Union (University of Tehran, 1971). The lack of political stability led to wars and disruptions of the social structure, which were not beneficial to agricultural development.

Since the beginning of the present century, relevant changes in the social structure or at least in the landownership took place countrywide, with significant repercussions in the Hamadan region. From 1920 onwards, contacts with the western countries drastically increased. Land reform came into action in the 1960s. The year 1979 is the beginning of the Islamic revolution. But the present social structure still includes some features inherited from earlier periods going back as far as 350 BC

The traditional rural social structure, before the land reform, was determined by the *boneh*, a collective production unit. The development of the *boneh* system was a social and economic answer to the harsh natural conditions, in particular the water shortage for agriculture. Farmers belonging to a *boneh* supported one another, compensating for the lack of official protection against natural risks. The resulting cohesion and strength of the rural societies have been dislocated over the last decades by a set of factors, such as rapid population growth, general welfare development, and introduction of modern agricultural techniques conducive to drastic land management changes and increasing use of groundwater resources.

TRADITIONAL FARMING PRACTICES

Irrigation water management

Contrary to the present situation where irrigation water is provided mainly by tubewells and dugwells from deep aquifers, in the past water supply varied with the physiographic conditions of the area. In mountains runoff water was harvested; in hilly areas the water of a neighboring river was often diverted; in piedmonts underground tunnels (*ghanat*) were dug, or use was made of springs (*cheshmeh*); and in valleys water was directly hauled from river channels using the Persian wheel. The most innovative is the *ghanat* technique, where a tunnel is excavated into alluvial deposits on a mountain skirt to tap the aquifers and bring the water to the surface by gravity flow for irrigation (Fig.1). In the 1980s, the water delivery of 158 *ghanats* in the Hamadan-Bahar plain was estimated 27.6 million cubic meters per year, with a discharge varying between 0.5 and 120 litres per second (Djamab, 1990).

The distribution of water, especially that of a *ghanat* gained after so much effort, is regulated by customs and laws going back often to pre-Islamic times and early Islamic

codification (Wulff, 1966). As ghanats are not equipped with any tap or valve, water flows day and night the whole year around. This might be a disadvantage when comparing with motorized deep wells. In practice, there are several traditional ways, very much village- dependent, to reduce water waste during the winter season and control its fair distribution among the users. Excess water was used to irrigate vineyards in winter according to a technique called *yakhaub* (*yakh*= ice; *aub*=water), which was believed to be useful against pests, and to fill up underground reservoirs (*aubanbaur*) and underground ice-houses (*yakhchaul*), both supplying drinking water in the dry summer.

The age of a ghanat may range from a few centuries to more than a millennium. A humus-rich topsoil horizon buried under a 1.5 m high ghanat mound was dated 1040 years BP. Comparatively, the mean residence time of the organic matter in the surface horizon of the soil exposed in the immediate surroundings of the ghanat mound was 370 years BP. Thus the selected ghanat is at least as old as 700 years, belonging to the Khwarazmian kingdom period. Considering its position on the landscape and the well-preserved access shafts, this ghanat is certainly not the oldest one in the area. Over centuries, people learnt and implemented techniques of water harvesting for irrigation purposes.

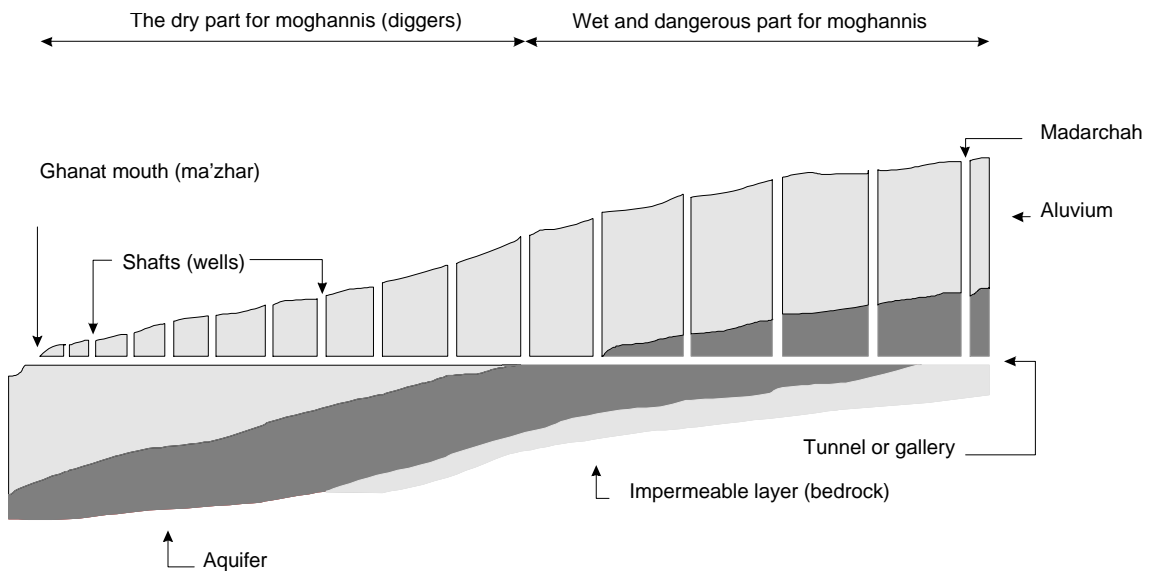


Fig. 1 : Schematic cross-section of a ghanat system

(*moghannis* = ghanat diggers; *madarchah* = the closest shaft to the mountain front)

Use of animal manure

Animal raising was an important component of traditional agriculture. Cow dung was mostly used for fuel but also applied to the land, particularly in orchards. Chicken, pigeon, horse and human excrements were used in summer crops (= *seifi*), such as vegetables and melons. Fertility in exhausted wheat and barley fields was restored mainly through fallow and rotation practices, but also by adding ash, house wastes and material from old house roofs and abandoned living places. Some decades ago, villagers practically ignored the use of chemical fertilizers (Wilber, 1950). The application of agrochemical in the country grew from little to 32 thousand tons per annum in the early 1960s, and to 675 thousand tons by the mid 1970s (Karshenas, 1990).

Manual tillage using animal-drawn wooden plough

Traditional land preparation for wheat and barley cultivation started with ploughing at the beginning of spring, around the new year (*nowrooz*), after the land had been under fallow for one year. The same tract of land was again ploughed in autumn, followed by the broadcasting of barley seed. In the case of wheat, seed broadcasting took place about twenty days after the second ploughing.

Nowadays, modern agricultural machinery is used in the different production stages from land preparation to harvesting, packing, transportation and marketing. This results from a deep transformation of the agricultural sector in recent years, while in the 1960s agricultural practices were still indigenous (Wulff, 1966). Now, traditional tools -- animal-drawn ploughs, different types of harrow, and scoops for preparing furrows -- are abandoned or only used in remote sloping and rocky areas, where no tractor can reach. The traditional draft animal was the ox, but mules, horses and donkeys were common too in the past.

Micropedologic investigations, using digital processing of thin sections, revealed that the calcareous soils of the area had far better physical conditions when traditionally tilled for centuries than when exposed to mechanized farming (Fig. 2; Farshad, 1997). The most important lesson to learn is that technology should not be copied blindly but adapted.

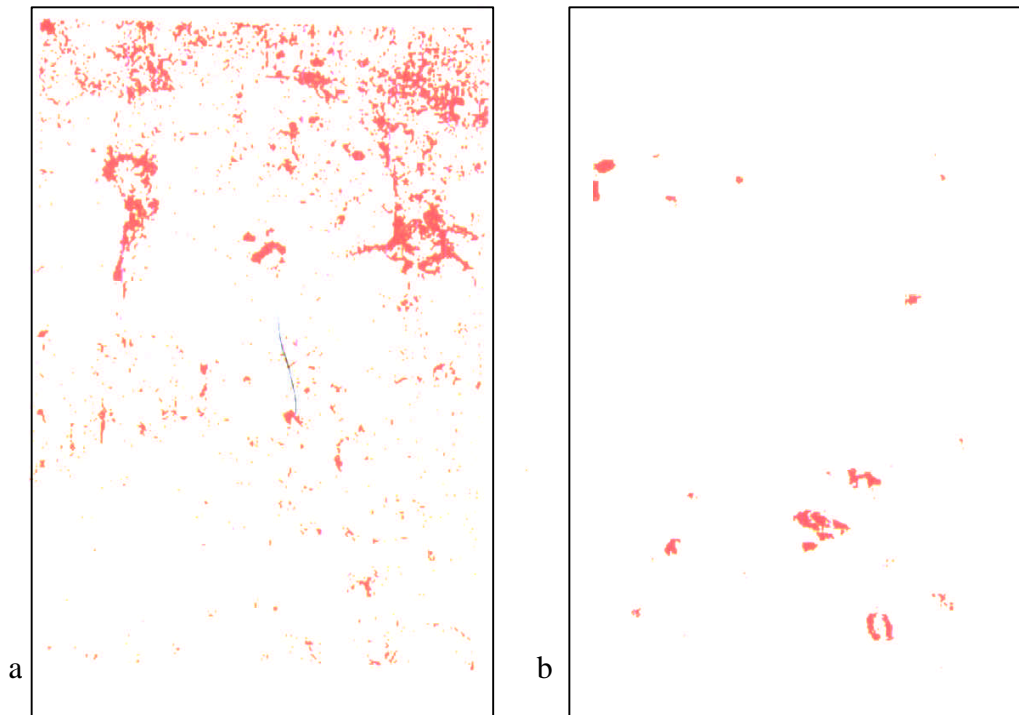


Fig. 2 : The effect of traditional (a) and mechanized (b) tillage on porosity

AN INTEGRATED PRODUCTION SYSTEM

A traditional production unit is a complex system of interrelated activities carried out by a household. It includes three main components : crop farming, animal husbandry and handicraft production (Fig. 3). The output of one activity may be input to another one, leading to an increasing transformation of the primary farm products (vegetal and animal) either for auto- consumption or sale. Functional integration and temporal distribution of the activities make that all family members participate full-time all the year around. The large variety of products generated helped mitigate all kinds of risks, from climatic (drought, late frost) to economic (market price fluctuations, product scarcity). Such an integration is the result of a long co-evolution between ecosystem and sociosystem (Farshad and Zinck, 1993).

Animal husbandry was present in all households. Oxen, cows, sheep, goats, hens and pigeons were common. Eggs, milk products, meat, flour from wheat and barley, vegetables, fruits, leather and wool were produced by each household with the active participation of all family members. On the other hand, large flocks of sheep and goats, belonging to powerful and often absentee landlords, were taken care of by paid shepherds. Sheep and goats were daily slaughtered for meat production. Animal skins were either exported to larger market centers or bought at the farm-gate by agents of small local factories. Many people were involved in leather beneficiation from cleaning and skin processing to dyeing, as well as in selling and shoe- making.

Wool from sheep and goats had to undergo a long process of beneficiation before it was ready for making carpets. This occupation, called *farshbauafi*, demanded the participation of many workers to make the wooden installations (*dastgauh-e-ghauli*), produce the cotton threads (*nakh-ris*), construct the basic thread-frames (*chelleh-dewan*), prepare the wool threads and dye them in different colours (*rangraz*), elaborate natural dyes from walnut shells, pomegranate skins and other natural substances, make the carpet designs (*nagh'sheh-kesh*), and finally weave the carpets (*ghaulibaf*). Except for some really specialized jobs requiring designers and carpenters, farmers were involved in almost all wool processing steps, on top of their farming activities. Women were mainly responsible for carpet weaving. The rural crafts were either marketed locally or otherwise exported to larger towns. Carpets and *guelims*, a kind of woven carpet, were mainly exported, ultimately to foreign countries.

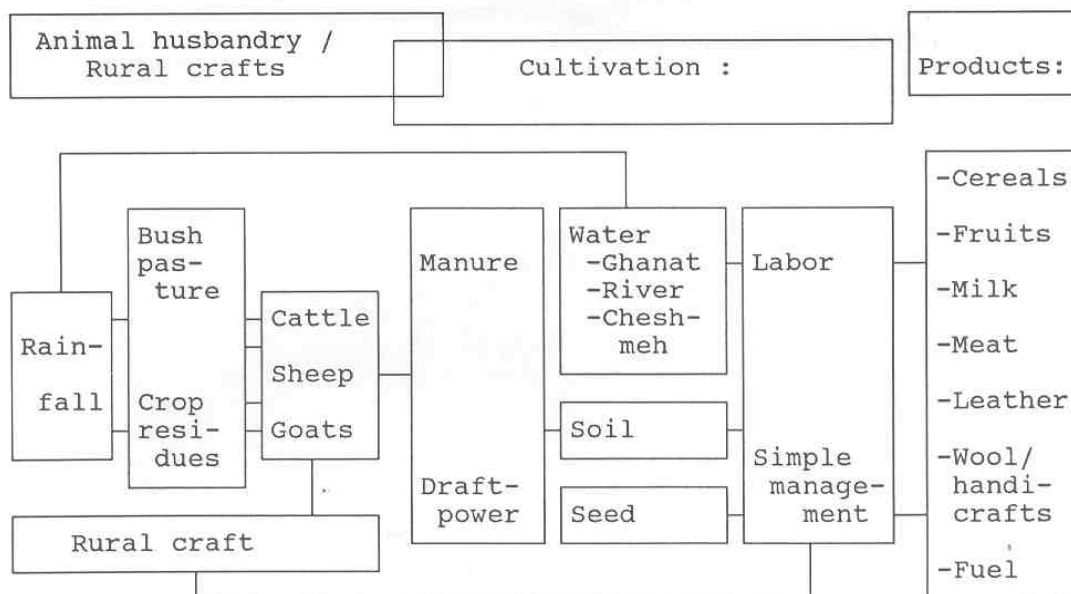


Fig. 3 : Model of a traditional farming system in the Hamadan province

CONCLUSION

Production factors of a traditionally managed farming system in the Hamadan area include irrigation water supplied from underground tunnels, springs and, to a lesser extent, harvested runoff; the use of manure in place of artificial fertilizers; and manual tillage using animal-drawn wooden plough. A traditional agricultural system is not confined to cropping but also includes the livestock and farm household. Activities such as meat, leather, milk and craft production, in a given frame of social values, community norms and landownership, are integrated with and control the farming system.

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Keywords : Indigenous knowledge, traditional agriculture, semi-arid region, Iran

Mots clés : savoirs locaux, agriculture traditionnelle, région semi-aride, Iran