

Minor Crops in Spate Irrigation in Pakistan

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Practical Notes Spate Irrigation

1. Introduction

This Practical Note describes some of the most important and most promising minor crops in the spate irrigated areas of Pakistan, and gives recommendations on how to develop the potential of such agricultural products as well. The exact definition of minor crops is to be seen in a relative rather than an absolute context. The adjective 'minor' usually refers to the cultivated surface, which is normally speaking considerably smaller than the area in which major crops are grown. However, what are minor crops in one region may be major ones in some other areas. Whereas major crops serve as staple food, minor crops are utilized as niche products.

Minor crops are mostly cultivated in multi crop systems under difficult conditions like moisture stress and seasonal variations. It is mainly the major crops - often grown as mono crops - that are getting the attention from research stations, commercial producers and corporate farming. Researchers and agricultural promoters have generally ignored minor crops. Considering the demand for food, however, minor crops can play an important role in meeting the needs of the country, and they may provide high value income opportunities for the population of spate irrigated areas. Farming systems moreover offer the natural environment for the genetic preservation of some unique crop species.

Minor crops are grown for their local importance, usefulness and fit into the overall agricultural structure. Spate farming is often characterized by a multi crop system in which a single field has more than one crop growing at the same time. Fruit trees, vegetables (both cultivated and wild), non staple foods, cereals for animal feed, indigenous varieties of oilseeds and pulses, as well as beans, grasses and mushrooms are mixed with other crops, but account for no more than ten percent of the total area grown. Although the cultivated surface for minor crops may be less, their commercial value - like for spices and medicinal plants - may be higher than that of the main crop in such fields.

2. Some important minor crops

A general belief is that every spate river has special minor crops suited to its hydrology, soil qualities and micro-climatic characteristics. Most minor crops are indigenous varieties, well adapted to local conditions for centuries under the spate farming system. Some minor crops grow naturally out of seeds which have remained in the soil, or have been carried by flood flows from afar mountain catchments. The cultivation of these minor crops does not require any special preparation, but the type of soil makes a difference. Crops like vegetables, cluster beans, tituk and sesame oil seeds for instance grow very well in adequately drained soil. Local farmers claim that under moisture stress conditions of spate irrigation some of these crops do better in terms of taste, colour and shape than they would if perennially irrigated, although the yield per unit might be less. This section presents a range of minor crops common to spate irrigated areas in Pakistan and discusses their possible uses.

Coarse grain varieties: sorghum and millets

The sorghum varieties from the Sanghar river in DG Khan and the Kachhi plains in Balochistan (Nari spate irrigation system) are famous in large areas. In the Sanghar spate irrigation system, local indigenous varieties of sorghum, known as ghogha and chuttiala, have been developed over a long period. They are used in different kinds of bread. The evolution of these special varieties of sorghum in the spate farming system shows that they can compete with any other modern type of irrigation in the region, if not in the country as a whole.

Pearl millet from Kanwhan and Bhaati spate areas in DG Khan as well as from various other spate systems are equally renowned. This is another local variety with characteristics of drought resistance and adaptability. It is used as a local animal feed, whereas its immature shoots are popular as 'fast food' ingredients. Moreover millet is used in local sweets and millet pops.

Box 1: Quality products

An opportunity to generate higher prices could lie in the fact that most of the farming in spate agriculture is organic, without using pesticides and chemical fertilizers. Unfortunately, the market for organic crops in Pakistan - unlike in India for instance - is as yet not well developed. At present, spate irrigated crops are generally recognized for their quality and taste. Due to the remoteness of spate irrigation areas the quality markets remain local, however.



Figure 1. Mung beans 'intercropped' with sorghum - Dadu District, Sindh, Pakistan



Figure 2. Millet field, Pakistan

In some areas millet, which is rich in protein, is used as a staple during the winter season. In spite of its highly nutritious value, however, it is not a common food item among urban residents in Pakistan. The major use is feed in the livestock and poultry sector. Particularly young chickens and pet birds are being fed with it throughout the country.

Cantaloupes, cucurbits and other vegetables

The cantaloupes of Litra river in DG Khan and Kullachi river in Pakhtunkhwa - formerly named North Western Frontier Province (NWFP) - are well-known all over Pakistan. Litra cantaloupes

are famous in nearby areas, whereas the ones from Kullachi are also sold in markets beyond the district boundaries. This cantaloupe variety originates from the area of these two spate rivers. Farmers elsewhere use its seed, preserving it in the native gene pool. The variety needs less water, suffers limited pest attacks only and has a good shelf life. The Kachhi plain is famous for its own early variety of cantaloupe, growing on spring spate floods and selling for good prices in Balochistan and Sindh markets. The Kachhi cantaloupes taste better and last longer than the ones from DG Khan and DI Khan, and can as well compete with varieties from abroad.

A unique melon-like cucurbit, called tituk (*Citrullus trigonus*), grows among others in the sandy spate areas of Litra, Bhaati and Kanwhan in DI Khan. The unripe fruits are used both in pickles and as vegetables. The sweet flesh of the mature fruit is used for human consumption, whereas the skin and flesh of cucurbits with a less pleasant taste is being fed to animals. Its seeds are processed in local sweets and its kernels in pastries. Seed and oil are used in herbal medicines. Nothing goes waste from this plant, confined to the spate system in the foothills of the Suleiman Range.

According to local history the tituk, which looks like a wild melon, has been domesticated in the area for ages. Its shape and taste suggest a close relationship with the Kalahari Desert melon (*Citrullus lanatus*) - seen as forefather of the watermelon - from Botswana. Tituk is a purely minor crop, sown by farmers as well as germinating from previous year's seed left over in a field. There it complements millet, sorghum and cluster beans. Moreover, it is sown as a mono crop on marginal lands and sand dunes, as it is highly drought-resistant. Another melon-like fruit is called tuma, a purely medicinal plant with an extremely bitter taste, marketed in herbal shops throughout Pakistan. Besides, tuma is offered as feed to goats and camels.



Figure 3. Tuma plant in spate irrigation area - DI Khan, Pakhtunkhwa, Pakistan

Spate irrigation farmers grow several other vegetables, depending on the moisture of the soil and the time of the year. Among them are tinda, okra, pumpkin, cucumber, fennel (*Foeniculum vulgare*), radish and turnip. Such products are not sold on the markets, but consumed by the farming families themselves.



Figure 4. Cucumber - spate irrigation region of Dadu District, Sindh, Pakistan



Figure 5. Sorghum - spate irrigation region of Dadu District, Sindh, Pakistan

Guar

Some minor crops are cultivated only for commercial purposes, and marketed wholly or partly on local, regional and even global markets. One such crop is guar (cluster beans), the gum of which used in industrial products ranging from confectionary items to gunpowder and textile dyeing. Guar is also popular in foods as it is a no calorie binding agent. Guar beans are sown when the moisture of the field and the magnitude

of the spate flow are insufficient to support major crops like sorghum and wheat. Sandy soils are more appropriate for this leguminous crop (i.e. improving the soil by accumulating nitrogen in it. As this leads to better quality subsequent crops on the same field, these beans are much liked by farmers. In spate irrigation areas they consider cluster beans a 'non thirsty crop'.

The immature pods of cluster beans are cooked as vegetables, being a main source of minerals and fibres for people in arid areas. Moreover, the valuable threshing straws are an important feed for animals like goats, sheep, cattle and camels. It is sold for high prices as it can be kept longer than straws of other plants.

Other pulses

In spate agriculture regions throughout Pakistan it is common to grow various pulses as mixed crops. Due to their leguminous nature they help to maintain and increase field fertility, and they are very suitable to 'intercropping'. Examples are mung beans (*Vigna radiate*), moth (*Vigna aconitifolia*), bakla beans (broad beans), chickpeas, and indigenous varieties of kidney beans. DG Khan and DI Khan have a considerable share in the country's total production of chickpeas. They prefer well-drained soils and are able to resist drought and water deficiency very well.

Wild plants

Although they may also be planted, several minor crops grow wild. The seeds left in the soil germinate usually after the area has been irrigated by the spate flow. *Sanwak* (*Echinochloa colona / frumentacea*), *cheena* (*Panicum milliaceum*) and *smookha* (*Panicum coccineus* - similar to *teff* in Ethiopia and Eritrea) are multi-purpose crops in spate irrigation areas. They fulfil various food needs of local populations and nomad groups in Pakistan. Bread and porridge are made with their seeds, their leaves and stems are used as roofing material and the whole plant serves as animal feed, especially in times of drought. *Sanwak* is an annual and perennial crop that grows naturally in spate fields. In the Kachhi region of Balochistan fields with *sanwak* continue for miles on end.

Box 2: The marketing of guar

Pakistan is an important producer of guar in the world - though far behind the United States (with Texas as main producing area). According to estimates by local marketers the production of guar in country averages 70,000 tons annually, ranging between 50,000 to 110,000 tons per year. Prices fluctuate: the crops of 2009 fetched PKR 36/kg, but prices in 2008 were PKR13/kg). The reason for the price jump was the small area under cultivation in 2009 due to low availability of spate flow to fields and lesser rains. The produce of last year 2009 was partly withheld from the markets because of speculation.

Within Pakistan guar trade is the monopoly of a limited number of wholesale buyers and factory owners, who largely control the market prices. Previously there were only four factories in the country - all in Karachi. One factory closed recently as it overpaid middlemen and farmers, but then could not get the desired profit margin internationally. The remaining three factories process the guar seeds before further marketing; the gum is extracted and the husk is sold separately. The gum is converted into powder shape and largely exported to the United States.

The three factories used to provide incentives to middlemen and sometimes farmers in the past but now no more and the marketing system has become less reliable. Previously the jute bags were provided by factory owners to middlemen in advance. The bags with the crops were paid on delivery but now it takes one to two weeks before payment is made, after factory owners have determined the quality of the produce. That was the reason that the produce of last year was stored by local middlemen. It was sold to factory owners when it was highly needed and terms, and conditions were more in favour of local middlemen than the factory owners.



Figure 6. Guar growing in spate irrigation area - Dadu District, Sindh, Pakistan



Figure 7. Guar-millet mix farming, DG Khan spate. Pakistan



Figure 8. Wild tinda sold at market



Figure 9.

Box 3: Truffle mushrooms

Among naturally growing crops, one of the most promising is the mushroom family that includes underground truffles. This desert truffle (*Terfezia leonis* Tul.) enters into symbiotic relations with other crops. It yields high prices on the markets in Europe. However, in Pakistan the possibilities for promoting this truffle are still uncharted.

They are the best patches for rangeland where livestock graze independently, and birds and wild animals hide. About half a century ago - before the green revolution - the patches were protected communally for the production of *sanwak*. In those days the people in the area used the *sanwak* seed to make porridge, the major part of their diet. Also loafs of bread were made from it, resembling the *injira* bread from Ethiopia and Eritrea. *Sanwak* is the best alternative to sorghum and other staple food during periods of famine in spate irrigated areas. In many areas in Pakistan *sanwak* porridge is eaten with cumin and honey. The people clean the seed in a special manner, using a wooden mortar and a pestle made from oven-burnt clay. Since the *sanwak* seeds are very small and weigh little, they easily jump out of the mortar during the grinding process. To overcome this, the women put raw cotton or pieces of paper to prevent the seeds from escaping. Two other plants, known in Pakistan as *cheena* and *smookha*, are called 'brother and sister' of *sanwak*. They are used similarly in rural areas. There for centuries local women have made weaning food recipes with *sanwak*, *cheena* and *smookha* seeds. Nowadays many rural people still make porridge and desserts with the seeds of these three plants. *Isabgol* (*Plantago ovata*) is a well-known wild medicinal plant. In spate irrigated fields it usually grows out of seeds from the previous year. Due

to winter spate flows this tends to happen more often. The husk of this plant is very useful for the treatment of chronic bacillary dysentery and chronic constipation. For centuries it has been used in the Indian subcontinent and in other regions. The medicine made with *isabgol* is sold against good prices. Nowadays several pharmaceutical companies are offering it in Pakistan as well as on international markets.

3. Recommendations

Minor crops in spate irrigated areas definitely deserve more attention. Many species and varieties among them are relatively unknown outside the areas where they are grown. The local varieties of coarse grains and pulses particularly present important gene pools. As niche products minor crops may yield high market prices, but to date their potential remains largely unused. The marketing appears to be showing several shortcomings. The minor crop is sometimes unexplored, as is the case with some wild vegetables and mushrooms. Quality aspects, such as the organic nature and taste of crops, may not be exploited. The example of guar shows that processing and access to international markets still need to be improved. To make more of the economic potential of minor crops we are recommending several steps:

- Systematically map the minor crops and their uses. This process applies to both annual and perennial crops, including wild vegetables. It should include current and potential productive uses, of the main produce as well as the by-products. Organizing special fairs could help to present the possible uses of the various minor crops to business partners- to be.
- Concentrate on very promising minor crops. It is important to give more attention to agricultural research and marketing surveys about possibly successful minor crops. An example of this is the truffle mushroom (see box 3), a delicacy in increasing demand that is already yielding high prices. Whereas researchers in Iran have been documenting the root strains on which these mushrooms develop, in Pakistan no such studies have as yet started.
- Invest in market chains. For some minor crops the markets chains need to be strengthened, closing the links between producers, processors and marketers. More profound knowledge about market requirements - quality, timing - helps selling these potentially high value products. Well-functioning market chains can be sources of capital and innovation - in terms of crop varieties, products and outlets. Up to now markets for minor crops are mainly local, and better quality or special characteristics are usually not rewarded. On the supply side, unreliable sourcing is the order of the day. To overcome such problems, investments in the various market chains are a necessity - not only in grading, storing and processing, but also in promotion, market development and the composing of secure contracts.



Figure 10. Guar crop before threshing

Colofon

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The Pakistan Spate Irrigation Network supports and promotes appropriate programmes and policies in spate irrigation, exchanges information on the improvement of livelihoods through a range of interventions, assists in educational development and supports in the implementation and start-up of projects in Spate irrigation. For more information: www.spate-irrigation.org.

